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The Ventilation of Street Cars

The Problem Becoming a Serious One Through the Wide Use of the "Pay-as-you-enter" Type of Car

There is no phase of ventilation more important than that dealing with street and railway cars. Some few of our modern sleeping cars have ventilating devices which are supposed to operate when the car is in motion. Not one of them can be considered satisfactory at all times, and of course all actually fail when the car is standing still.

The same unsatisfactory condition is to be observed on street cars.

Many cities have ordinances calling for the ventilation of cars; very few of them enforce these ordinances. Nearly all cars, whether for railroad or street railway service, have windows in the monitor decks. No means is provided for exhausting the air other than that there is some slight suction created when the vehicle is in motion. No means is provided for introducing air other than that which may leak in. No means is provided for heating this air as it comes in. In cold weather the openings will be usually found closed.

THE DETROIT SYSTEM

On our modern through trains on the railroads the temperature varies generally from 50°, with drafts, with the monitor deck sashes open, to 100° or even higher, in the berths next to the windows with these deck sashes closed. Detroit has for some time past had a system of car ventilation in use on the surface street cars. Stoves are placed in the front vestibules. Air is taken from outside and passed up around these stoves in casings, and from the casing is introduced into the cars at the front end. The air gets out through the back door, provided the back door is open.

This scheme works fairly well when the car is in motion and when the back door is open. The faster the car goes the better the results. The average speed of street cars, however, is only from 10 to 12 miles per hour. When moving at the highest speed the door is nearly always shut. The front end of the car gets most of the ventilation; also the top part of the car is ventilated much better than that part where the people sit. There is no ventilation when the car stands still. This Detroit system can only be applied to those cars which run on a loop, using one end only for the motorman and never reversing.

CHICAGO STREET CAR VENTILATION ALSO UNSATISFACTORY

For some time certain Chicago city railway cars have been equipped with cold air inlets in the front ends in the monitor decks. These take air in when the car is in motion. The air finds its way out through the deck sashes, when open, at the opposite ends of the car and through the rear door when it is open. The temperature of the car cannot be kept up to 50° in cold weather if much air is admitted. This arrangement is open to all of the objections of the Detroit scheme and does not have

the advantages of the former in introducing the air at a temperature above that outside.

MODERN TYPE OF STREET CAR HARD TO VENTILATE

Since the advent of the "pay as you enter" cars, which bid fair to displace all other types in street railway service, the question of ventilation is becoming even more serious, as the front vestibule acts as an air lock and there is little or no circulation whatever of the air in the car, except through some special ventilating device.

THE PROPOSED CHICAGO ORDINANCE.

The city of Chicago has a very much alive health department. There is an ordinance now before the city council there calling for the introduction of not less than 350 cu. ft. of fresh air per passenger per hour, the minimum requirement, based on the carrying capacity of the car, being not less than 28,000 cu. ft. of fresh air per hour per car. This ordinance also provides that the air shall be introduced at the floor line and exhausted at the ceiling.

During the past two years a number of devices for accomplishing ventilation to comply with this ordinance have been tested. Most of them are unsatisfactory. Nearly all provide for openings in the floor of the car with ducts leading from these openings underneath the electric heaters along the sides or underneath the seats. Some of them place scoops on the fresh air inlets to divert the air into the car, these being serviceable when the car is in motion. Some of them have vanes on the roof working on the principle of an ejector or aspirator to draw the foul air out.

It would appear that any system of this kind, which obviously must be dependent upon the motion of the car and affected by its speed, would be unsatisfactory. Three hundred and fifty cars are to be equipped with mechanical ventilation in which the air is drawn in through openings in the floor through the electric heaters as described above, and exhausted through a large number of registers in a false ceiling, the foul air space thus formed being connected with a small fan and direct-connected motor on the roof of one of the vestibules.

It has been found by elaborate tests that the air, in volume to comply with the ordinance, can be heated by the electric heaters to the necessary degree and that the cost of running the exhaust fan is nominal. A special motor has been devised, uniform in construction with the motor used for propelling the car, so that attention and lubrication required is practically negligible. There is also no trouble on account of the noise or vibration from this fan.

It is believed that along the lines of this mechanical system we may hope for satisfactory results in the ventilation of all cars. There is no reason whatever why the air introduced, instead of being heated by electricity, could not as well be heated by hot water or steam. Nearly all Pullman cars are now equipped with electric fans. Nearly all railroad terminals where cars stand "open for occupancy after 9 p. m." are equipped with electric power so that positive ventilation could be obtained without any difficulty. It is believed that any railroad which would provide mechanically ventilated equipment and properly advertise the same would receive a preference in patronage over its competitors who did not have this equipment.

It is believed that the health statistics of any city equipped with ventilated cars will show a marked improvement on this account. The progress of Chicago is being watched with great interest. There is absolutely no doubt but that proper ventilation of transportation vehicles will greatly reduce mortality from filth diseases and promote the health and happiness of the human race.

The American Society of Heating and Ventilating Engineers is in accord with the Chicago Health Department in promoting car ventilation as well as ventilation of all buildings, and the foregoing information is from the publicity committee of this society.

The Relative Efficiency of Exhaust and Live Steam in Heating

An exhaustive discussion of this topic was a feature of one of the sessions of the recent annual meeting of the American Society of Heating and Ventilating Engineers. The substance of the discussion is contained in the following abstracts

MR. D. D. KIMBALL: I did not suggest this topic, but I would be glad to hear some discussion of it. I noticed in taking up a copy of THE HEATING AND VENTILATING MAGAZINE this morning an advertisement in which it is stated that exhaust steam is capable of doing 80 per cent. as much heating as live steam. I think that is a moderate statement in comparison with an occurrence that I experienced. For instance, in a certain central heating plant the question of buying current instead of continuing the lighting plant was taken up, and we suggested that that would equal the coal burned per hour running the engine, if we did; that the steam would stop. To our amazement we found that there were 74 lbs. of coal less used with the engine running that when stopped.

At a large insane asylum in Massachusetts three years ago they were short of boiler capacity and they found difficulty in heating their buildings. One Sunday they found difficulty in carrying heat to the end of the building, and the superintendent complained to the engineer. It was during mid-day, and the only part of the plant that was not running were the engines. So they started the engines and turned on all the corridor and other lights that they could, and within an hour the complaints about heating stopped.

In one plant that we visited, we found some difficulty in circulating the steam direct from the reducing valve, and upon starting the engine 2,100 ft. away we took out a plug and we could distinguish the pulsations of the engine.

I have heard the claim made a good many times, and I have almost come to the conclusion myself, that the steam leaving a boiler might go through the engine and into the heating system without losing any efficiency so far as the heating system is concerned.

MR. THEO. WEINSHANK: I can repeat the experience of Mr. Kimball's. I designed a plant where we had a 600-H.P. engine, and we guaranteed that we would heat the building with the exhaust steam, which we did. Winter weather came, and we carried the same pressure at night as during the day, 1 lb. It took considerably more fuel at night than in the daytime. I was called in, and they said: "We carry the same pressure at night as we do in the daytime, 1 lb. Why do we take more coal?" I said, "Run your engines and turn the exhaust steam into the system." They said, "It will take more coal." I said, "Let's try." So we started the engines and ran the electric light plant. It is a plant taking in 17 buildings, considerably scattered.

We started the generator and were amazed to find that it took less coal. As a result of our experiment, they have been running their electric light engines day and night, and at night they turn on every light, and I was informed that the insurance was decreased on account of the plant's yards being lighted up with arc lights. They found that it cost them a little bit more than the wear and tear on their lamps, but they saved more than enough in fuel to pay for that loss.

MR. D. M. QUAY: I wrote one or two articles some time ago on the cost of producing electric current by isolated plants, and have been criticised quite a little by some of the advocates of central plants. Some claimed that my statements were incorrect, and tried to prove that the cost of heating buildings by live steam was a very small item. The

statements of the last two speakers put the matter a great deal stronger than I had any idea was the case. Of course, if we can heat as well with exhaust steam as we can with live steam, then there isn't any question about the advantage, under certain conditions. Especially in a large plant, it is a question of whether current can be produced by an isolated plant much cheaper than it can be produced by a central plant, and I am very certain that when that question is investigated there will be a great many more isolated plants put in, especially when there is a large amount of current required.

PROF. WM. KENT: If it is found that you can get the power, plus exhaust steam heating, for less coal than you can get the heating alone with live steam, then the only thing to do is to look for the cause. I once found in a plant where they had three boilers that they could generate steam cheaper with less coal, by using two boilers instead of three. I found out the reason, though, by inquiring further. When they had two boilers they had to be careful to fire right, but if they ran three they grew careless. So the whole secret of running the power plant and heating may be due to the fact that when the greatest amount of coal is used, the fireman does not fire the boiler in the same way; that is, he shovels the coal carelessly on the grate and lets the air go through, so that you are not only raising steam but heating a lot of useless air to go out of the chimney.

MR. JAS. A. DONNELLY: The rough statement that it takes more steam at night than in the daytime to heat a building means nothing. I have heard that it took more steam on Sunday in an office building in New York than on a week day with the same outside temperature.

Granted that we make a certain amount of steam in the boiler and send it to the radiators as live steam, and we use more coal; it merely shows probably that the radiator surface for some reason condenses more steam, because we do not believe that steam can go anywhere else except by being condensed. Of course, some waste steam may be brought around and condensed or blown into the sewer.

MR. KIMBALL: Referring to Mr. Donnelly's statement about the different amounts of heat required during day and night on account of the different conditions in the building, I cannot imagine any building where the conditions are more uniform than in an insane asylum, where 2,000 patients or occupants of that institution are confined under restraint and are practically in the same condition day and night, so that the conditions are practically the same day and night. Yet even there, with the light plant running in the afternoon, say in December or January, at the time our records were obtained, they were burning less coal during the running of the engine than during the stop period of the engine.

It may be worth stating that the horse-power required for the engine was only about one-third of that required for the heating. It is probable, of course, that only about 10 per cent. of the heat units were used in the engine itself, developing energy. In the case I speak of, the engines are located in an isolated building, so that the heat of the engine itself is not used in the building, despite the fact that there is less coal used when running the engine.

I can duplicate that in a plant where a lighting plant was installed. The plant had run for eight years without the lighting plant. The lighting plant was then installed, and despite the fact that the weather temperatures were no higher than the year before, they burned 100 tons less coal.

MR. F. H. STEVENS: As engineers and designers of central station plants we have had considerable experience in this line, which has proven to us that the value of exhaust steam for heating is considerably in excess of that of live steam.

In a number of instances, where the total exhaust steam from the engine has been used for heating, after the engines were closed down, it was necessary to add other boilers to maintain the pressure in the heating mains to supply the heat alone. Now, so far, we have no good, plausible, acceptable reason for this. My idea of it is that the economy comes not from the work of the engine or anything of that sort, but is in the efficiency of the boiler under different conditions. We find that by using the exhaust from a steam turbine we get exactly the same results as by using the power, but by putting the steam into a reciprocating engine we get entirely different results. My theory is that the effect of the interrupted flow, due to the cutting off of the engine, has something to do with the matter.

MR. A. G. PAUL: The question put is the relative efficiency of exhaust steam and live steam in heating. There isn't any difference, unless you make a different set of conditions. So many horse-power of exhaust steam against so many horse-power of live steam is the same, but if you change the conditions you change every element.

If you take 1 lb. pressure off a building, you will save 3 per cent. of the entire coal consumed, as far as heating it is concerned.

The same result can be brought about by the use of live steam. If you reduce the pressure you reduce the amount used to produce a given result. When you pass steam through a reducing valve you dry that steam, you even superheat it for a certain distance. It takes up all the moisture that gets into it.

PROF. J. D. HOFFMAN: I would like to ask Mr. Paul if 1 lb. of exhaust steam is equal to 1 lb. of live steam in heating value?

MR. PAUL: Yes, under the same conditions.

MR. ED. K. MONROE: There is one thing in this connection that has not been touched upon, namely the impulsive way in which the steam is let into a heating system from a reciprocating engine. One gentleman has stated that the results obtained from live steam through a turbine were not to be compared with those obtained through a reciprocating engine, and I think everything that has been said leads up to the fact that the increased heating effect and power of exhaust steam is most likely, if not positively, due to the intermittent admission of steam into the system, caused by the reciprocating engine. My explanation of that would be along the line of the work that the hydraulic ram does. We know the great power accomplished through the hydraulic ram. I don't think there is any difference in the work of lifting water through a ram and the work accomplished in the distribution of steam through a system from a reciprocating engine, due to the fact that the expansive power of the steam has a better chance to get in its work by being bumped intermittently into the system.

MR. STEVENS: That is true as far as the circulation goes, but that does not explain anything in regard to the amount of heat that is given off by the steam after it has got into the radiating surface.

MR. MUNROE: I meant to say further that owing to the fact that steam is admitted intermittently, it expels the air from the iron of the radiator and gives the steam a better chance to get to all the surface that is exposed to the air.

PROF. KENT: Some of the gentlemen have stated that steam that comes impulsively out of a reciprocating engine is better than the steam that flows steadily, as from a steam boiler or reducing valve. I think they should prove their case, if they can.

MR. JAS. A. DONNELLY: Suppose for a moment we put in 1,000 sq. ft. of direct radiation and turn live steam into it. According to everyone's statement here, it takes more live steam than it does exhaust steam to get the same results. You put in exhaust steam and you yet

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burn less coal, and some one says that, therefore, exhaust steam is more efficient for heating than live steam. The question could be settled by weighing the condensation in each case.

In making some tests regarding the inner surface of radiators, I found that after they are used a long while they have a great deal of corrosion in them. The oxide never breaks off, but when we put oil in them it cleans all the inside off again and coats the inner surfaces with oil. I can see where that might make considerable difference on the inside when used with live steam and when used with exhaust steam. That, however, would not explain the difference between night and day.

MR. PAUL: The higher the temperature of the heating medium the higher will be the temperature of the air at the top of the room. The lower the temperature of the heating medium, the lower the temperature of the air at the top of the room, while the average temperature between the floor and the ceiling will not vary anywhere near as much. Therefore, if you have a lower temperature in your heating medium, you have to put fewer heat units in it to maintain a uniform temperature.

*Performance of Heating Guarantees**

BY WILLIAM KENT

In Prof. John R. Allen's paper on "Coefficients of Transmission in Cast Iron Radiators," in the Transactions of the society for 1908 (published in THE HEATING AND VENTILATING MAGAZINE for August, 1908), he gives some formulas for determining to what temperature a room should be heated when the outside temperature is above zero, in order to prove the performance of a guarantee that the heating apparatus will heat the room to 70° when the outside temperature is zero or other specified low temperature.

One of his formulas, applicable to a two-column cast-iron radiator, is:

$$\frac{(t_3 - t_2)\ [0.0036\ (t_3 - t_2) + 1.32]}{t_2 - t_1} = \frac{(t_3 - t_5)\ [0.0036\ (t_3 - t_5) + 1.32]}{t_5 - t_4}.$$

For a three-column radiator the formula is the same, except that the coefficient 0.0036 is replaced by 0.00467 and the term 1.32 by 1.14.

t_1 = temperature of the outside air for the contract condition.

t_2 = temperature of the room, guaranteed by the contractor.

t_3 = temperature of the steam in the radiator during the test.

t_4 = temperature of the outside air during the test.

t_5 = computed temperature of the room for the test conditions.

The unknown quantity is t_5, and its determination involves the solution of a quadratic equation. The formula is based on the assumption that the coefficient of transmission of heat through the radiator per degree of difference of temperature is not a constant, but equals a constant, 1.32, plus a fraction of the difference, 0.0036 $(t_3 - t_2)$, for a two-column radiator. The coefficient of transmission through the walls and windows is, however, taken as a constant, $= (W/4 + G)n$, in which W is the wall surface, G the glass surface, and n a factor for exposure, taken usually at about 1.20.

In the discussion of Prof. Allen's paper, Mr. W. W. Macon presents a couple of tables and a method of calculation by which the temperature of the room for different outside temperatures and different temperatures of steam or hot water may be found (published in THE HEATING AND

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VENTILATING MAGAZINE for October, 1908). With each temperature of steam or hot water in the tables is given a factor by which the number of degrees that the outside temperature is above zero is to be multiplied, in order to obtain the number of degrees above 70° to which the room must be heated during the test. Mr. Macon's tables are based on the assumption that the coefficients of heat transmission per hour per degree of difference of temperature between the steam and the room, and between the room and the outside air, are both constants.

While Prof. Allen's assumption that the coefficient of heat transmission varies with the temperature difference is probably more accurate than the assumption that it is a constant, yet the error of the latter assumption is so small in any practical case of testing the performance of a guarantee of a heating plant as to be of no importance.

The usual guarantee is to heat the room to 70° in zero weather. If the temperature of the steam is, say, 220°, and the outside temperature 40°, the room may have to be heated to something like 100° to equal the 70° — 0° guarantee, making a temperature difference between the steam and the room of 220 — 100 = 120 instead of 220 — 70 = 150, and the temperature difference between the room and the outside air 100 — 40 = 60 instead of 70 — 0 = 70. Taking Prof. Allen's value of the coefficient for a two-column radiator, $1.32 + 0.0036 (t_3 - t_2)$, for 120° difference it is 1.75, and for 150° difference, 1.86. The difference between these figures is less than the accidental difference between two radiators of the same size subjected to test under slightly varying conditions.

More than fifteen years ago the author published in *Engineering Record* (August 11, 1894) the formula given below for determining to what temperature the rooms should be heated with various temperatures of the outside atmosphere and of the steam or hot water in the radiators.

Let S = sq. ft. of surface of the steam or hot-water radiator;

W = sq. ft. of surface of exposed walls, windows, etc.;

T_s = temperature of the steam or hot water, T_1 = temperature of inside of building or room, T_0 = temperature of outside of building or room;

a = heat-units transmitted per sq. ft. of surface of radiator per hour per degree of difference of temperature;

b = average heat-units transmitted per sq. ft. of walls per hour per degree of difference of temperature, including allowance for ventilation.

It is assumed that within the range of temperatures considered Newton's law of cooling holds good, viz., that it is proportional to the difference of temperature between the two sides of the radiating-surface.

Then $aS\ (T - T_1) = bW\ (T_1 - T_0)$. Let $\frac{bW}{aS} = C$; then $T_s - T_1 = C\ (T_1 - T_0)$; $T_1 = \frac{T_s + CT_0}{1 + C}$; $C = \frac{T - T_1}{T_1 - T_0}$.

If $T_1 = 70$, and $T_0 = 0$, $C = \frac{T_s - 70}{70}$.

For T_0 =	—20	—10	0	10	20	30	40° F
	Inside Temperature T_1.						
Ts							
140° F	60	65	70	75	80	85	90
160	58.7	64.3	70	75.6	81.3	86.9	92.5
180	57.8	63.9	70	76.1	82.2	88.4	94.5
200	57.0	63.5	70	76.5	83.0	89.5	96.0
212	56.6	63.3	70	76.7	83.4	90.1	96.8
220	56.4	63.2	70	76.8	83.6	90.5	97.3
250	55.6	62.8	70	77.2	84.4	91.6	98.8
300	54.7	62.4	70	77.7	85.3	93.0	100.7

The formula as given above was also published in the author's Mechanical Engineers' Pocketbook (7th edition, page 546), and the following calculations have since been made:

Let T_s = 140° 160° 180° 200° 212° 220° 250° 300.

Then C = 1 1.286 1.571 1.857 2.029 2.143 2.571 3.286, and from the formula $T_1 = (T_s + CT_0) \div (1 + C)$ we find the inside temperatures corresponding to the given values of T and T_0 which should be produced by an apparatus capable of heating the building to 70° in zero weather.

In Prof. Allen's paper the following results are given of the case of steam heating with steam at 227° F. (5 lbs. pressure).

Outside temperatures	—20°	—10°	0°	10°	20°	30°	40°
	Room Temperatures.						
2-col. radiator	58	64	70	77.5	83	90	97
3-col. radiator	59	64	70	75	83	89	95
The author's formula gives	56.2	63.1	70	76.	83.8	90.8	97.7

For temperatures from —10° to 40° the author's results are within one degree of those of Prof. Allen with the two-column radiator. Results obtained by Mr. Macon's method of calculation are identical with those obtained by the author's formula.

It is submitted that on account of the simplicity of the author's formula, and its practical correctness in the light of our present knowledge of heat transmission, together with the convenience of the above table, they should be generally adopted by heating engineers and used in making guarantees. The following is suggested as a brief form to be used in specifications:

"It is agreed that when it is not convenient to the contractor to wait for an outside temperature of zero Fahrenheit (or other stated low temperature) in order to make a test of the heating plant, then a test may be made at any time when the temperature is not above 40°, and the rooms must then be maintained at a temperature found from the following formula:

$$T_1 = \frac{T_s + CT_0}{1 + C}; \quad C = \frac{t_s - t_1}{t - t_0};$$

in which T_1 is the temperature to be maintained in the rooms, T the temperature of the steam or hot water in the radiators or coils, and T_0 the temperature out of doors during the test, and T_1, T_s and T_0 the corresponding temperatures named in the guarantee."

In addition to the table given above, the following factors may be used by which to multiply the degrees of difference between zero and the outside temperature at the time of the test, in order to find the number of degrees above 70° at which the room temperature is to be maintained, the guarantee being 70° at zero weather:

Temp. of steam or water	140	150	160	170	180	190	200	210	250
Factor	0.500	0.533	0.563	0.588	0.613	0.633	0.650	0.668	0.720

Steam, gauge pressure	0	1	2	3	4	5	6	8	10
Steam temperature	212	215.3	218.5	221.5	224.4	227.2	229.8	234.8	23.94
Factor	0.670	0.675	0.680	0.684	0.688	0.691	0.695	0.702	0.708

A Device for Street Car Ventilation

A forced circulation hot-air car heater, known as the Peter-Smith heater, has had a trial in Des Moines, under the direction of Trainmaster E. W. Warren, of the Des Moines City Railway Company. The trial has been declared successful and it is expected that by another winter the street cars of Des Moines will be equipped with heaters of this type.

The system is designed to not only heat the car evenly, but ventilate it at the same time. The plant consists of a small hard coal heater on the front platform. The stove is encased in two steel hoods that keep the heat inside. On top of the heater is a motor-driven fan which brings the air from the outside of the car, passes it through the stove and then forces it underneath the seats through registers. During one of the trial trips in weather approximating zero conditions, the car was kept at 65°.

A New Code for Testing Heating Plants in Other Than Zero Weather

The value of a code for gauging the capacity of heating plants to maintain a 70° temperature inside with the outside temperature at zero, for use when the outside temperature may be above or below zero, has long been agitated among heating engineers. At the annual meeting of the heating engineers' society a year ago the matter was made a special subject of investigation, which was taken up by the Society's Committee on Tests, with the following results:

It was found that in 1903 the Society's Committee on Standards made a very complete report on the subject.

"In this report," states the Committee on Tests, "the following equation was used to give for any room the required inside temperature during test, at any given outside temperature, so that the requirements of the heating system would be the same as if tested in a room with 70° inside temperature when the outside temperature was zero:

$$t = 70 + \frac{(T - 70)}{T} t_0$$

where t = temperature to be maintained in room during test; T = temperature of the steam or hot water in the radiators, and t_0 = outside temperature during test.

FEATURES OF THE CODE OF THE COMMITTEE ON STANDARDS

"Some of the important points in the code were as follows:

"1. The temperature of the water or steam maintained in the radiators shall be the same as that allowed by the contract to be maintained in order to maintain a temperature of 70° in the building when it is zero weather outside;

"2. The difference between the temperature of the steam or water in the radiator and the temperature maintained inside of the building during the test, shall not be less than 0.8 of the difference between the temperature of the steam or water

A TABLE OF INDOOR AND OUTDOOR TEMPERATURES SHOWING EQUIVALENT HEATING CAPACITY TO 70° INSIDE AND 0° OUTSIDE.

Room Temperatures Fahr.

Outside Temperatures — Temperature of Radiator	160°	170°	180°	190°	200°	210°	220°	230°	240°
0°	70°	70°	70°	70°	70°	70°	70°	70°	70°
2	71.1	71.2	71.2	71.2	71.3	71.3	71.3	71.4	71.4
4	72.2	72.3	72.4	72.5	72.6	72.7	72.7	72.8	72.8
6	73.4	73.5	73.7	73.8	73.9	74.0	74.1	74.2	74.2
8	74.5	74.7	74.9	75.0	75.2	75.3	75.5	75.6	75.7
10	75.6	75.9	76.1	76.3	76.5	76.7	76.8	77.0	77.1
12	76.7	77.0	77.3	77.6	77.8	78.0	78.2	78.3	78.5
14	77.9	78.2	78.5	78.8	79.1	79.3	79.5	79.7	79.9
16	79.0	79.4	79.7	80.2	80.4	80.7	80.9	81.1	81.3
18	80.1	80.5	81.0	81.3	81.7	82.0	82.3	82.5	82.7
20	81.2	81.7	82.2	82.6	83.0	83.3	83.6	83.9	84.1
22	82.3	83.0	83.4	83.9	84.3	84.7	85.0	85.3	85.5
24	83.5	84.1	84.6	85.1	85.6	86.0	86.4	86.7	87.0
26	84.6	85.3	85.9	86.4	86.9	87.3	87.7	88.1	88.4
28	85.7	86.5	87.1	87.7	88.2	88.6	89.1	89.5	89.8
30	86.9	87.6	88.3	89.0	89.5	90.0	90.4	90.9	91.2
32	88.0	88.8	89.5	90.2	90.8	91.4	91.8	92.2	92.6
34	....	90.0	90.8	91.5	92.1	92.6	93.2	93.6	94.0
36	....	....	92.0	92.8	93.4	94.0	94.5	95.0	95.4
38	....	....	....	94.0	94.7	95.4	95.9	96.4	96.9
40	....	....	....	....	96.0	96.6	97.2	97.8	98.3
42	....	....	....	....	....	98.0	98.6	99.2	99.9
44	....	....	....	....	....	....	100.0	100.6	101.2
46	....	....	....	....	....	....	....	102.0	102.6
48	....	....	....	....	....	....	....	....	104.0

in the radiator and the temperature to be maintained in the building when it is zero outside;

"3. In no case shall the temperature outside be greater than 48°, even though the allowable temperature under the second requirement shall be greater than 48°.

"In addition to these points the Committee on Standards included minute directions for conducting such tests.

NOT APPLICABLE TO INDIRECT HEATING PLANTS

"The report above referred to expressed the opinion that heating plants heating buildings by indirect methods, could not be tested when the outside temperature was above zero and show the capacity of the plant with 70° inside when the outside temperature is zero.

THE COMMITTEE ON TESTS' TABLE

"Your Committee on Tests begs permission to present a temperature table which has been worked up from the formula given above and which will probably be applied more quickly than the formula. This table and formula may be used only in case of direct radiation, steam or hot water, and should show the relative capacity of the radiation, although not necessarily showing the capacity of the boiler.

PREVIOUS DISCUSSION OF THE SUBJECT

"At the semi-annual meeting of 1908, Mr. Macon offered a topical discussion upon the same subject and presented tables for steam and hot-water radiation plants, such that the pressure range for steam systems was from 10 in. vacuum to 10 lbs. gauge. He also supplemented the tables by a chart used by Captain Emile Mathieu, instructor at the Military School of Belgium (published in L'Hygiene du Batiment, for July).

"Your Committee on Tests has compared the table derived from the Code report and the chart last referred to, and have found that they check almost exactly, showing that the two are derived from the same theoretical basis.

"In the same year (1908) Professor Allen presented a paper on 'Coefficients of Transmission in Cast-Iron Radiation,' which checks with the formula and temperature chart fully as well as the values given in Mr. Macon's paper, there being no greater than one degree difference in any calculation."

The report is signed by J. D. Hoffman, chairman, and Theo. Weinshank.

The Boiler Rating Question

Discussion of the Majority and Minority Reports on Ratings for House Heating Boilers, at the Annual Meeting of the American Society of Heating and Ventilating Engineers

MR. E. A. MAY: As a member of this society, I do not think it would be advisable, with the rather diverse opinions held by members of this committee, for this society to adopt and use any formula or basis which has been proposed. In the first place, taking the majority report, there seems to be nothing taken into account with reference to the different designs of boilers, whether such boilers be round or of the sectional type, and it seems to me rather stretching the point somewhat to say that a boiler with a certain grate area shall be definitely rated at a certain fixed amount of radiation. The arrangement of the heating surfaces, the sizes of the flues in the boiler, the conditions as regards draft, the depth of fuel, all have a bearing on the efficiency of the boiler, and to say that a boiler with 1 sq. ft. of grate area, burning coal at the rate of 2.67 lbs. per hour, must develop an efficiency figured out on the basis of 7.98 lbs. of water per pound of coal, does not seem logical for this reason:

The committee in its test recommends that there shall be fired 50 lbs. of coal per square foot of grate surface after the boiler has run under normal conditions for one hour. Taking the average figures of 50 lbs. of anthracite coal to a cubic foot, that means a depth of fuel of only 1 ft. The committee, however, recommends that the total coal burned should be set at 2.67 lbs., and that a small boiler shall run on an eight-hour basis. Allowing 20 per cent. reserve for rekindling, it means that such a boiler shall have a total fuel capacity of 26.7 lbs. And yet in their test, they say that we shall burn 50 lbs. of coal. Taking the statement of 26.7 lbs., it means that we must have a depth of fuel for an eight-hour run of 6.7 in. Now, with that depth of fuel we will soon have no fire at all, and, further, at the rate of 2.6 lbs. of coal per hour it is very rare that you can get an evaporation of 7 lbs. of water per pound of fuel, even though on the dry fuel basis the heating value of the coal is 13,000 B. T. U. per pound.

Again, taking a boiler of 1 sq. ft. of grate surface, it would have to evaporate on the proposed test basis, 8.99 or 9 lbs. of water per pound of coal on a four-hour run, with a depth of fuel of 8 in. In my experience, no boiler has evaporated, on a 2-lb. rate of combustion, any such amount of water as is recommended by the committee.

The committee does not define what shall be six, eight or four-hour period boilers. It calls them small, medium and large.

The National Association of Boiler and Radiator Manufacturers has recommended to this committee a formula or method of rating boilers, which I believe should be the only basis which this body could hope to follow, until opportunity has been given for making a series of tests to be carried out by this body and from which you can adopt your own formula. The proposed formula laid upon the boiler manufacturers' association the obligation to absolutely stand back of their ratings, and it seems to me if the manufacturer will guarantee to you his rating, that under certain conditions the boiler will evaporate so many pounds of water per pound of coal, as the coal is received from the mine, when run at a certain rate and under normal conditions of draft, that that is all this body can desire.

PROF. R. C. CARPENTER: I find in studying these two reports that they agree in principle. But they differ very materially as to how far we should go in defining standards. The general committee has suggested that we divide boilers into a very large number of classes, and they have given an arbitrary table which they have not explained. Their table certainly does make the committee's system a very complicated one. Both of these methods are expected to conform to the standard on the area of grates. Both these methods are exactly the same so far as the measurement of the capacity of the boiler is concerned. Both of them proceed to measure the capacity and call a square foot of radiation 250 B. T. U. Both reports agree in recommending that a committee be appointed on boiler tests.

Now the principle point of difference is, it seems to me, a very important one. Mr. Seward, in his report, has divided his boilers into four classes. These classes, I assume, are taken simply as a matter of convenience. He assumes the firing periods for each of these groups as varying from eight to four hours. In the general committee report, the time of firing, it states, in no test shall be a shorter period than eight hours, although the time of firing is not definitely fixed.

In a series of tests we made last year we found the time of firing has a good deal to do with the efficiency. We can get a much higher efficiency out of a boiler with short periods of firing than with long periods. We found, however, no trouble whatever with running the boilers with eight-hour periods of firing.

Mr. Seward recommends that the question of efficiency be left to the

boiler manufacturers, and that seems to me a very good idea.

MR. W. W. MACON: In referring to the minority report, one must admit that in the second paragraph of section C, the provisions are broad, allowing, for example, a depth of as much as 20 in. of fuel, which might allow, for instance, for a rate of combustion of as high as 10 lbs. per square foot per hour. They are certainly broad when they allow, in section A, second paragraph, that firepots of irregular shape may be properly considered.

MR. P. H. SEWARD: The committee has contended that the increase in the rate of combustion should be by curve or formula progressing in straight lines from the small boiler to the larger one. I regard such a thing as wholly impracticable for any boiler manufacturer to live up to. If you will recall, house-heating boilers are nearly always made of cast iron and made from patterns in sections which are assembled together to produce different sized boilers. I think it will be generally accepted as a fact that after you have determined the efficiency of your heating surface there should be a constant ratio between the heating surface and the coal burned. If your surface has a value of 2½ lbs. of water to a pound of coal, if you increase your rate of combustion you must necessarily increase your heating surface. Now I think it is impossible for anyone to build a boiler of cast iron, as they are built to-day, that will be able to maintain a constant ratio between the coal burned and the heating surface by progressing the rate of combustion as shown in the table in the majority report.

By dividing boilers into classes, you overcome that objection. The small boiler can be built, with its heating surface and its value known, at a constant ratio from the smallest size of that class to the largest, and so on up to the highest division.

MR. H. T. GATES: Recently a number of manufacturers made a very exhaustive series of tests of their boilers, and it would seem to me that the information would be of value to the society. I think the appointment of a new committee would have the benefit of what has been done by the manufacturers.

*A Review of the Subject of House Heating Boilers as Contained in the Heating Engineers' Proceedings**

Boilers for steam and water heating have received most generous consideration by our society, and it is probable that the proceedings we have published contain more information about design and proportion of such boilers than can be obtained from any other source.

Several papers which show the result of careful thought and study of some particular feature of heating boilers have been presented by our members, but it is in the discussions that we find the most valuable and comprehensive treatment of the subject.

The consideration which is given to the boiler as a fundamental part of heating and ventilating installations is indicated by the frequency with which we find allusion to some of its features or functions in discussions on papers or topics dealing primarily with some other branch of the profession.

In the earlier meetings the heating boiler is alluded to and approached with more or less hesitancy and reserve; but in the later years more familiarity is shown, and every meeting has disclosed a growing tendency to give boilers the consideration they deserve as an active agent for the success or failure of heating and ventilating apparatus.

*From the report of the Review Committee for 1910 on heating boilers, Percival H. Seward, chairman.

At the first annual meeting the heating boilers were discussed in two papers dealing with internal circulation and methods for making joints in sectional constructions, which goes to show that our society is invaluable to any engineer who is at all desirous of keeping in touch with such details of the profession as are receiving prominence in current discussion and investigation.

The question of a more desirable and accurate method of ascertaining and expressing the power of heating boilers was being agitated in 1896, and it is, therefore, not surprising that in Vol. II of our Proceedings, which covers the second annual meeting, we find, on page 56, remarks by Mr. Jellett to the effect that makers' catalogues cannot be followed as to the economical generation of steam in from that time to the present have house-heating boilers.

While the papers and discussions been most generous in volume and have covered every phase of heating boiler development, it cannot be shown that any definite or fundamental rules have been laid down or established as to the best methods to be pursued in design, manufacture and operation.

The work of a society such as ours is largely research, and it is problematical if its functions cover anything beyond or can be made to serve a more useful purpose than has been indicated. The lessons learned from our papers and discussions are apt to be carried away and used by our members in their every-day affairs, and as the difficulty which prompted their investigation is relieved, the subject is naturally more or less closed and disappears from our proceedings.

This is aptly illustrated by the question as to a relation between the steam and hot water rating of the same heating boiler. Prior to 1897 the practice was very variable and the resulting figures most confusing. There was no uniformity or any apparent effort to get at the real considerations. At the summer meeting in 1897 Mr C. A. Mott read a paper on the subject, and while there is no evidence of his suggestion being adopted or standardized, it is nevertheless a fact that since 1897 there has been and is a definite relation between the steam and water ratings of heating boilers, and on the basis which was outlined in the paper referred to.

It is very evident to me, from the most careful perusal of our proceedings, that no student of heating and ventilation can ever hope to be fully and properly advised on every phase of the subject without becoming one of our members.

The qualification for membership fortunately takes in all those who have the business at heart, whether as designers, manufacturers or erectors, and for that reason the society is most valuable to each of us, no matter in what branch we may be engaged or interested.

The report includes a list of the papers presented and topics discussed in Vols. I to XIII, inclusive; also a subject index, so that such information as may be desired in connection with investigation of some particular feature of heating boilers can be readily located and referred to.

An Interesting Method of Testing House Heating Boilers

The method of testing house-heating boilers, used by the American Radiator Company, was described at the recent annual meeting of the heating engineers by Mr. Edwin A. May, one of the company's engineers. The tests as at present conducted are the result of 10 years' actual experience, wherein one method would be tried long enough to establish the fact that it did not give exact results or the data required, when it would be altered accordingly.

"We have finally developed a method," said Mr. May, "which, although not perfect, has been endorsed by all the leading engineers abroad. Our present method of tests consists of first building a wood fire and bringing the water to a steaming point, then rapidly withdrawing the

wood fire and kindling a coal fire. However, we made this condition: that the new charge of fuel should be put in just as rapidly as firing would permit. We do not say as rapidly as possible, because if that were left to the fireman, he might take it to mean just as soon as the fresh coal is ignited, while it may be two hours before he gets his full charge.

"We allow as a minimum one-half hour after the charge shall be placed on the fire before commencing the test. In other words, the length of run does not start from the time we begin to put in the coal, but after the coal is on the fire.

"We make the test by feeding water from a pressure tank under pressure, the water line being maintained at a constant level throughout the test by means of compressed air in the tanks. The tanks are calibrated to an exact reading, so that by the reading of the gauge we know at any minute how many pounds of water have been fed to the boiler.

"When our new research department building at Buffalo is ready, we will do away with the preliminary wood fire, because it is a very dirty method and at best rather cumbersome to operate, and the water will be fed into the boilers measured from a tank, which has been heated to the boiling point by means of steam coils or by similar means.

"We feed the water from this pressure tank and get its temperature from readings taken every 10 or 15 minutes. From the start to the finish of the test the drafts are not regulated other than to maintain a constant draft, indicated by a draft gauge. The fire, therefore, is not touched in any way, the grates not even being sliced, so that we get an exact condition such as would be found in an actual installation.

"We also make a test for rapidity of steaming, which is the length of time in which the boiler can be made to burn out its fuel and the corresponding efficiency obtained thereby. We also maintain a series of tests with a fire check balance to see how long the boiler will carry steam and how long it will carry its fire and the results obtained under these conditions."

MR. P. H. SEWARD: I would like to ask Mr. May if he will give us his method of testing water boilers.

MR. MAY: Our system of testing water boilers is with tanks with temperatures kept at various points, both with the water being constantly agitated and still, so that we get a comparison of the two methods. I would say further that in the case of a steam boiler used with a hot water system, the evaporative test of that boiler is just as good measured by the capacity for water as it is for steam.

MR. T. B. CRYER: I would like to know how Mr. May pipes his boiler and gets the results of his tests.

MR. MAY: After we start the fire the boiler begins to steam. We have it piped from the top through a separator to a weighing tank, which takes any condensation which may come from the pipes. The average of all the readings is taken and corrections made for condensation in the pipes and in the separator; sometimes we carry two separators in series. We have carried out the tests with the boilers under pressure and at atmospheric pressure, and have found practically no difference in the results.

PROF. J. D. HOFFMAN: In regard to tests conducted by your company, is it assumed that all the steam that leaves the separator is dry steam and that the percentage of moisture is what you get out of the separators, or do you have calorimeters on the line?

MR. MAY: We do not use calorimeters, because our experience has shown that the calorimeter readings or the handling of calorimeters is extremely annoying, and it takes so much time and gives so little appreciable result that we have found, inasmuch as we were within the limit of the maximum amount of moisture allowed, that it would not affect the

capacity of efficiency of the boiler to any extent.

MR. J. J. BLACKMORE: As far as the calorimeters now on the market are concerned, we cannot use them below 35 lbs., and that is a pressure at which cast iron boilers are rarely used.

The Cause of Water Lifting in Steam Mains and Radiators

The influence of low pressure or vapor vacuum systems toward lifting water from the boiler to mains and radiators was one of the topics discussed at the recent annual meeting of the heating engineers. Mr. George D. Hoffman, who spoke on this subject, said:

"I cannot conceive how any man can imagine that vacuum has any power in itself. Vacuum means an absence of power. In order to lift water there must be an unbalancing of the pressure somewhere, and the only way that water can get up into the main is simply because there is a trap from the boiler in some way that permits an unbalancing of pressure. Generally speaking, I have found that where water goes up into the mains it is either caused by the priming of the boiler or an excess of velocity in the steam coming out of the boiler into the main. I often find cases where engineers say that water is held up in the radiator by reason of a vacuum appliance being placed on the radiator. That is a fallacy. Water is not held up in the radiator by vacuum, unless the pipe leading to that radiator is trapped.

"Where a radiator is piped in such a way that there is a slight trap in that pipe, the condensation coming from the radiator will gradually fill the trap, and whether or not the radiator is equipped with a vacuum appliance, the water will gradually collect in that trap and stay there."

MR. ANDREW G. PAUL: Water will also hang up in the radiator provided the supply pipe is too small. If the velocity of flow of the steam in a one-pipe job and the connections to it are too small, the water cannot go back against the velocity of the steam coming in.

A Proposal to Make Air Washers of Vitreous Material

A report submitted to the American Society of Heating and Ventilating Engineers on the subject of air washers contains a proposal to improve the construction of air-washing devices by making them of enameled porcelain, the idea being that by this construction the cleaning of these devices, which is frequently required, would be greatly facilitated. Speaking to this report, Mr. Sam Kauffman, president of the Kauffman Heating & Engineering Co., St. Louis, makers of the Kinealy air purifier, stated that the proposition was a commercial impossibility with the weight of material now required to be used in air washers. "In addition," said Mr. Kauffman, "the iron of which the eliminator is made could not be made of vitreous material because it would buckle or crack and would not last as long as the present construction. If we are going to use a material that is everlasting, I would recommend copper of a heavy gauge.

"With the air washer in operation, I do not think the baffles will contain any dirt whatsoever, either on the eliminator or washer sides. With the apparatus not in operation, the air will be drawn in on the outside and deposited on the baffle plate. The idea of lighting the interior of the apparatus is a good one."

MR. S. R. LEWIS: I would say that I have seen many air washers installed in buildings, in which the eliminators could not all be reached. Merely spraying water on them would not remove the dirt, slime and silt. I think the time will come when it will be necessary to make the baffles of vitreous material; they could be made out of cast iron and enameled.

MR. E. S. BERRY: I would like to inquire if any of the members of the society in actual work, using these

air washers for increasing the humidity of the air, have found in actual practice that increasing the amount of humidity has saved any fuel in the plants where they are installed.

MR. J. I. LYLE: The idea that less fuel is used where an air washer is installed is a fallacy. In anyone will stop to figure the amount of latent heat necessary for evaporation of moisture, they will soon find that the amount saved by carrying 65° instead of 70° temperature is more than offset by the amount of heat it takes to evaporate the moisture. Mr. Lewis speaks of the eliminator vanes becoming foul. I have never seen an eliminator blade that was foul, and I have seen both the horizontal and vertical tanks. I want to ask if the kind he spoke of were vertical or horizontal, or whether he noticed the same conditions with each.

MR. LEWIS: As I recollect, the air washer in question was in a plant which we installed, and it was a vertical tank. I think there is no question that they would not become foul if the air washer was constantly operated, but the washer is not always run when the fan is going.

Suggestions for the Use of Humidity Devices

"All measurements of relative humidity should be made with a sling psychrometer," was the opinion expressed by Mr. R. A. Collamore, of Detroit, speaking on the subject at the recent annual meeting of the heating engineers. "The ordinary hygrometer, which hangs on the wall," he continued, "is misleading. In many cases you will find a relative humidity that is considerably lower than when measured with a wet apparatus." Mr. Albert A. Cary, speaking on the same subject, said: "The sling psychrometer is an instrument in which moist air will collect around the wet and dry bulbs, and you will get a wrong result if you depend upon still conditions, but if you have an electric fan that is not sufficiently close to produce rapid evaporation, or if you take an ordinary fan and fan the bulb you will get a fairly good reading."

Speaking further on the same general topic, Mr. A. M. Feldman, of New York, said: "In connection with the humidifying of a house, in an instance I have in mind, I placed two pans in different parts of the house and placed thermostats to control the humidity at the pans. You can set the thermostats to hold the humidity at a certain percentage, but that will not give you the same humidity with different temperatures outside, because with the same humidity inside on some days you will get it too damp and other days too dry. The proper way would be to have under the pans an indirect radiator and have it controlled from the room not at the dampers, but at the pans. If regulated in that way, you can get the proper percentage of humidity required in each room. It would be expensive, but it could be done."

"The fabric manufacturers," added Mr. Cary, "have looked into the subject of automatically regulating the moisture in the air very carefully. In one mill, I saw a large piece of blotting paper suspended, which would absorb the moisture very rapidly. This was hung on the end of a scale beam, and when the moisture saturated the blotting paper to a certain extent, it would tip the beam and cut off an electric communication with the humidifier, and the fan would be operated alone. Very soon the blotting paper would become dry, when the scale beam would return to its original position and thus start the humidifier."

Variations in Air Flow at Inlets and Outlets of Ventilating Systems

In an interesting discussion of the variability of air flow through the inlets and vents of a heating and ventilating system, before the heating engineers' society, Mr. S. R. Lewis, of Chicago, cited a case where he was in consultation, advocating a double fan system, as op-

posed to an indirect system with coils at the base of the flues and very large vent flues.

"We tested a plenum job," he said, "in which we found that we could get through the vents about half the air we wanted out of the fan blast. The rest went out of the walls and ceiling and cracks. Then we testel the gravity indirect job, and we got fully twice as much air out through the vent flues as we were putting in the rooms. The claim was made then that the indirect gravity job gave better ventilation than the plenum system.

"In this connection, I understand the new Vermont ventilation law calls for the removal from the rooms through the vent flue of as much air as is admitted through the fresh air inlet. I do not believe it is possible to accomplish this, except, perhaps with the double fan system. I think we are getting the necessary ventilation when we deliver 30 cu. ft. of air per minute, whether or not we get that all out through the vents. Some of the air that has been breathed goes out through the walls or ceiling."

MR. R. A. COLLAMORE: I take it that with a wind pressure against the glass surface of an outside wall, if the windows are not tight, there will be a leakage of air into the room. I have not made experiments to prove it, but I take it that this action would create a zone near the window in which the air is cooler than at the inner walls of the room, and would, perhaps, affect the circulation of the air in the room to the extent that the air would not always reach the portion near the outside wall. Also, the cold air leaking in would be added to that passing out through the vent.

So that it is possible in a school room to have more air taken out of the vent flue than enters the room by the air inlet. Conversely, if there is no decided wind acting on the building, it is possible for the air to leak out through the windows, in which case, and this is the ordinary case, there will be less air taken out of the room through the vent flue than enters at the fresh air inlet.

Furthermore, the effect of that on the room ventilation is such as to decrease its effectiveness, because even if you are delivering the requisite amount of air into the room through the air inlet, which is stated to be nominally 30 cu. ft. per min., it is true that a large amount of that air will enter and leave the room without descending to the breathing line.

PRESIDENT SNOW: Perhaps Mr. Whitten will explain a little more fully how the tests are conducted by the Massachusetts inspectors, with the measurements taken preferably at the vent outlets.

MR. H. W. WHITTEN: The rule laid down by the late Rufus Waite for measuring air velocities at inlets and outlets was that anemometer readings be taken at various points across the face of such inlets and outlets and the average readings be taken.

The Massachusetts police have abandoned the so-called powder test for ascertaining the air flow, and now use extensively thistle-down of fox fennel, which is very light indeed and will float for a long time, even better than tobacco smoke. This thistle-down is placed in front of the inlets and its course observed. Then more of it is let loose in front of the windows. It has been found in a great many cases that that let loose in front of the windows will drop a bit, then describe a rough circle and light back again on the window.

Use of Deflectors and Diffusers in Air Inlets

Interesting variations in practice in the construction of air inlets of ventilating systems were brought out in a discussion at the recent meeting of the heating engineers' society in New York. The matter came up in connection with an inquiry as to what part of the inlet an anemometer should be placed in or-

der to get the actual velocity of the air. One of the speakers had stated that the dead air space at the face of the inlet was determined in each case by the anemometer. "Unless the inlet has been divided by deflectors," he added, "the air forms an eddy at the bottom of the grill. The greater the current the stronger is this eddy and the less direct outflow there is. I have seen, with a supposed 1,200-ft. velocity, the actual outflow cut down far below 300-ft. velocity, for that very reason."

MR. S. R. LEWIS: I have never been able, in testing, to satisfy myself that there is any advantage in putting in curved deflectors at the outlet and thus trying to make the air coming into the room have a uniform velocity at all points of the opening. Air is so elastic, in my opinion, that once it gets started coming up a flue, say at the rate of 1,500 ft. per min., no matter whether the outlet be restricted a little on account of the eddy caused by the square inlet, it has got to spread around in the room, and you cannot discover by any difference in the room whether these deflectors are in there or not.

MR. R. A. COLLAMORE: I think it is desirable to have deflectors, although they may not be very effective. If you have had any experience with teachers in school rooms, you will appreciate the fact that they object very seriously to what they call drafts. By placing deflector plates in the openings, although you do not gain ideal conditions, you get a lower average velocity, or, at least, the effect of the air delivered is not so noticeable.

MR. F. G. MCCANN: In regard to the use of deflectors and diffusers, we have used both in New York public school work. We have used a diffuser, closed at the end, which throws the air up towards the ceiling and spreads it all over the room. Our objection to such a diffuser is that the boys will throw their hats in there and there will be a certain accumulation of dust which will only be blown out when you start the apparatus in the fall.

MR. LEWIS: An air duct in the basement has usually two or three elbows in it, but we do not put deflectors in there. Also where the duct joins the plenum chamber there is approximately a square elbow, but we do not put deflectors there either.

MR. MCCANN: There are some instances where I have used square elbows at the air inlets with better results than with round. The reason, in my judgment, is that with a square elbow you get an eddy of the air in the corner. You will get a fairly even flow from the register opening, but with a round corner, the air will come up and will be deflected down around the heads of those seated directly below.

MR. H. W. WHITTEN: That is what the deflector is designed to prevent.

MR. MCCANN: The deflector, of course, will do that, but if you are going to leave out a deflector, it will be better to use a square elbow.

MR. ALBERT A. CARY: Reasoning from a purely theoretical standpoint, I should think that instead of getting a uniform delivery of air, we would get the opposite. It is well known that as a mass of air passes up a vertical pipe, the friction on the side of the pipe causes a bucking back, so to speak. In other words, the air next to the frictional surface is deadened and the freest air is, of course, that which passes through the center of the pipe. Now, with this detention of air on the outside surface of our elbows, we induce still further friction with the deflector plates, as has been shown, and reduce the outflow of air.

At the outside of the turn, the tendency of the air might possibly be to flow a little freer, but as there is more frictional surface presented here, the tendency would be to increase the air flow at the center of the outlet and decrease it at the top and bottom. If it were possible to get sufficient space to put in something like a Venturi tube, we might get a more even flow of air.

MR. A. M. FELDMAN: It is quite customary to have the air inlet box a great deal larger than the duct. I have tested some of those boxes and found no air coming out at all at some points, and I remedied that by putting in these deflectors.

Another way of evenly distributing the air from the outlet is by carrying out the diffusers several inches into the room.

MR. E. A. MUNROE: I believe that if the inlet were carried out 6 in. beyond the wall of the room we would get the results that we want.

MR. MCCANN: I cannot agree with the last speaker. The idea is to overcome the effect of crowding the air.

The Relative Cost of Operating Vacuum Systems of Exhaust Steam Heating with Various Amounts of Vacuum

The following is part of a discussion of this topic on this subject at the recent annual meeting of the heating engineers' society:

MR. A. A. CARY: Generally, the lower the vacuum the greater the efficiency of the plant. The advantage of a vacuum is found in the fact that if our steam mains are not perfectly level or inclined in the direction that steam and water are supposed to run, it makes very little difference. In one plant a return pipe was run right over a door, and, with a vacuum constantly maintained, there was no trouble in lifting that water over this point of obstruction.

MR. D. M. QUAY: There are several reasons why a low vacuum is better than a high vacuum. It is very hard to get return valves that will stand a high vacuum, and they will not if you are going to throw a large amount of steam through the system, which is not the best way to heat a building. You lose efficiency when you carry a high vacuum, unless in cases where it is absolutely necessary for other reasons to do it.

MR. WARREN WEBSTER: We have been about 22 years in the business, and we find it very difficult to formulate specific rules that will apply everywhere. There are a number of points to be considered in each case, such as the size of the pipes, the amount of radiation, and whether there are lift points or gravity returns. In giving my idea of the desired degree of vacuum to be maintained, I would say that we endeavor to get 2 in. of vacuum at the most distant radiator from the source of supply, and then maintain a degree of vacuum at the pump which will give that as the minimum at the most distant radiator. It may require 6 in. of vacuum at the pump and, if so, we set our governor accordingly. In cases where there are heavy lifts, it may necessitate, in order to maintain 2 in. at the most distant radiator, possibly 20 in. of vacuum at the vacuum pump. In gravity conditions, we may be able to get along with 3 or 4 in. of vacuum at the pump and be able to maintain 2 in. of vacuum at the most distant radiator.

In regard to the quantity of steam required, it depends altogether on what kind of return valve devices are used for retaining the steam in the radiators and removal of the water and air at the same time in order to insure the maximum radiating efficiency for each square foot of radiation. At first, it is true, it took very large pumps, where the leakage of steam from the radiators to the returns was very great. Devices were improved until now we get over 98% efficiency. That is to say, to every 98 lbs. of condensation there will not be over 2 lbs. of vapor which will be condensed in the return piping, therefore no loss or jet water required at the vacuum pump.

Some 10 years ago we made some tests in regard to the quantity of steam used, and I would say a general rule would be that the steam consumption of the vacuum pumps was from 1 to 5 per cent. The 1 per cent. or 5 per cent. would be dependent upon the kind of vacuum pump and conditions of the plant, and would be represented in the quantity of steam condensed in that particular heating system.

THE HEATING AND VENTILATING MAGAZINE

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HEATING and ventilating engineers are generally agreed upon the substance of desirable compulsory ventilation laws. The maintenance of the proper degree of purity of the air, it is conceded, can be obtained in school rooms and similar apartments by the supply of 30 cu. ft. of fresh air per person per minute. This figure is incorporated in all of the laws and regulations now on the statute books or in force in States which have taken action on the matter. There is, however, a wide diversity in the wording of the various requirements and in one case, at least, a decidedly questionable wording, that would seem to make it highly desirable that greater uniformity could could be secured, especially in the bills now pending as well as in those which will inevitably come up for consideration in the future. The progress of compulsory ventilation in the United States, as outlined in our issue for February, shows very clearly that the time is ripe for the passage of compulsory ventilation laws in many, if not all, of the States which now have no regulations on the subject. It would be a great advantage if those who are working for the passage of such laws could have a standard form of bill which could be enacted in each State in the form presented or, at most, with only minor changes in the requirements or phraseology made necessary possibly by local conditions.

THE DIVERGENCE now existing in the prescribed manner of fulfilling the requirements of the law may be seen by comparing the Massachusetts regulations with those which were recently promulgated in Vermont. While the amount of fresh air stipulated in each case is the same, the Massachusetts regulations require that the determining measurements shall be taken at the vent outlets, while in Vermont the apparatus must supply at least 30 cu. ft. of air per minute for each person accommodated in the rooms, besides which "vitiated air in amount equal to the supply from the inlets should be removed through the vent ducts." This, under weather conditions which occur frequently, has been declared impossible by reputable heating engineers, and in view of recent tests showing the widely varying figures between the amounts of air supplied and exhausted from the same rooms at the same times, the futility of the requirement is apparent. Indeed, the opinion has been expressed that a law with such a requirement would undoubtedly be declared unconstitutional.

If a standard form could be prepared embracing the essentials of the laws now in force on the subject, it would seem to be the first step to be taken in the furthering of the movement to make ventilation compulsory throughout the Union.

MECHANICAL EQUIPMENT

High Pressure Steam Piping

PART III

Figuring Economical Steam Velocities

BY PERRY WEST, M.E.

The foregoing discussion and curves, which appeared in the February issue of THE HEATING AND VENTILATING MAGAZINE, are based on an even rate of steam flow. Other conditions must be reduced to an equivalent of this even-flow condition before the formula and curves are applied.

Owing to the various conditions of service, some classes of high-pressure piping do not naturally afford an even flow of steam, nor is it always good practice to use the most economical velocity of flow regardless of other considerations. The following may be said in this respect regarding: (1) boiler leads, (2) engine leads, (3) and turbine leads.

BOILER LEADS

For boiler leads, sizes are sometimes kept above the economical, due to the danger of priming with too high a velocity in the outlet. For boilers with attached superheaters the leads from the superheaters may be designed for the most economical velocity, inasmuch as priming is impossible. The same is practically true if properly designed dry pipes are used. The best practice to-day is to allow a velocity of 4,000 ft. per minute in boiler leads when no special provisions exist against priming. This velocity is largely a matter of judgment, however, and experience must be relied upon in its determination. Broadly speaking, the velocity in boiler connections could no doubt be materially increased above present-day practice, with the result that losses would be decreased and the system made more flexible against expensive strains. This matter of flexibility, depending as it does upon the connections to the fixed points, should have a very material bearing upon their sizes.

ENGINE LEADS

Under this heading will be classed the supplies to all kinds of reciprocating steam-driven units. The leading peculiarity in figuring the sizes for these is due to an intermittent demand for steam in the cylinder. This causes an intermittent flow in the supply pipe, and in the headers themselves from which the supply pipes lead. In reasonable-sized stations, having several units, this effect in the headers may be neglected. In smaller plants it should be considered and allowances in header sizes be made. In the design of any station having several reciprocating units, the selection of speeds should be such that no two units will have commensurate numbers of revolutions. Otherwise two or more units may fall into step in such a way as to take steam together periodically, with the resulting bad effects in headers which are found in the engine leads themselves. Especially is this true of alternating-current electric generating units running in synchronism.

The disadvantage of the pulsating flow in engine leads is, that with the same quantity of steam per hour to be supplied through the same size pipe, a greater maximum velocity is necessary, with consequently more wire drawing and a greater drop of pressure.

This unevenness of flow in the case of a reciprocating unit is not only that caused by the steam being admitted to the cylinder for a por-

tion of the stroke only, but a further unevenness of flow during this period of admission itself is caused by variations in the speed of the piston.

In other words, the volume cleared by the piston and subsequently occupied by the incoming steam has a variable rate of increase, this rate beginning at zero on the end of the stroke and increasing to a maximum near the center.

Take, for example, an engine cutting off at one-quarter stroke, the maximum rate at which steam is taken at cut-off, is not four times what it would be for continuous admission, but is increased to 7,256 times the average rate, due to the variable piston speed. This increase in velocity, if allowed to extend to the supply pipe, causes an increased drop in pressure through it, and coming as it does at or before cut-off, has considerable effect upon the economy of the engine.

Receivers or receiver separators are generally installed in the supply pipe near the engine throttle, for relieving this situation, and are satisfactory and effective, if properly proportioned. Another function of the receiver is to relieve the system of shocks and strains which would otherwise be caused by the intermittent flow of the steam, and to afford an ample and ready supply of steam at the throttle at all times.

The elimination of vibrations of this character is of the utmost importance as far as the life and maintenance of piping is concerned. Its ill effects, such as crystallization and leaky joints, are well understood, however, and need no further comment here.

Let

U = Loss in B. T. U. per pound of steam transmitted by radiation from the receiver,

H = Loss in B. T. U. per pound of steam transmitted due to friction in the supply pipe,

p = Drop of pressure in the supply pipe,

P = Initial pressure, absolute,

V = Ratio of receiver volume to cylinder volume.

Then

$$p = \frac{3\,P}{16\,V}$$

nearly, for cut-off at one-quarter stroke, for if the engine is cutting off at one-quarter stroke, $\frac{1}{4\,V}$ will represent the fraction of the whole receiver volume taken out during admission.

If the flow into the receiver is assumed constant, there will have been replaced in the same length of time

$$\frac{1}{4} \times \frac{1}{4\,V} = \frac{1}{16\,V}$$

of the total receiver volume. This will still leave the receiver minus $\frac{3}{16\,V}$ of its volume at cut-off, and since dry steam may be taken as a perfect gas,

$$p = \frac{3}{16\,V} \times P = \frac{3\,P}{16\,V'}$$

from which

$$H = K\frac{3\,P}{16\,V} \text{ (nearly).}$$

The fixed charges on the receiver may be reduced to its equivalent in B. T. U. per pound of steam transmitted and then be added to U plus H, and the size receiver be selected which will make this sum of all charges against it a minimum.

TURBINE LEADS

Turbine leads differ from the reciprocating-unit leads in that the flow of steam is generally even. Some types of turbines are fitted with governing mechanism which admits steam to the turbines intermittently. In such cases the piping requirements are somewhat the same as for the reciprocating unit. The vibratory evils are practically the same. There is a difference as to steam velocities, however, which should be noted, i.e., admission is more nearly continuous than for an engine under similar conditions.

HEADERS AND MAINS

In estimating the sizes for headers and mains, it is generally safe enough to assume an even flow. None of the special conditions just cited for the other three classes of supply pipes need apply to mains. Some former practices have tended toward large sizes for headers, but this scheme is not generally followed to-day.

The idea in using large headers was to have the additional capacity in piping perform some of the functions of a receiver separator, the lowering of velocity tending to separate entrained water, and the capacity acting as a receiver between the boilers and engines.

Still another point was that water would not be so readily picked up and carried to the engine, thus eliminating a most important element of danger.

Better practice along all these lines seems to be to design the headers and mains as carriers only, and to make proper allowance in the rest of the apparatus for taking care of the other features mentioned. Receivers placed near cylinder inlets are more effective and less wasteful of heat by radiation than is a large header.

Piping should be designed so as to drip clear of water pockets and allow for full velocity. With superheated steam at high pressure it is easier to keep the piping free of water than it formerly was with low-pressure saturated steam. As far as any separating action in the headers is concerned, it is better that this be left to the separators, where the facilities for draining the water away are better.

American Society of Mechanical Engineers

The programme for the joint meeting of the American Society of Mechanical Engineers and the Institution (British) of Mechanical Engineers, July 26-29, next, provides for two days' session in Birmingham and one day's session in London, the intervening day being devoted to excursions. Among those who have arranged to attend the joint meeting, in addition to those announced in last month's issue, is Prof. R. C. Carpenter. In all 205 members, including 155 ladies, will be included in the American delegation.

Variability of Interior Conditions in School Rooms

Among the papers read at the last annual meeting of the American Society of Heating and Ventilating Engineers was one by Mr. H. W. Whitten, which included a lengthy table of figures taken from inspectors' reports on Massachusetts school buildings, compiled by Mr. Joseph A. Moore, deputy chief, Massachusetts District Police. The figures show remarkable differences in interior air conditions in school rooms, with apparently similar volumes of air supply and degrees of temperature. In many cases the outlet air volume was twice that of the inlet, while in others the reverse was the case. In some cases the temperature of the room was higher than that of the air supplied at the inlet, while the volume of outlet air was very much greater than the supply.

These discrepancies have now been explained, to a great extent, in a letter we have received from Mr. Joseph A. Moore, in which he states:

"These tests were made under varying conditions of temperature, humidity, barometer, wind, and in various parts of school buildings. The conditions found were chiefly where janitors or teachers had not properly regulated the supply of warm air into or the exhaust of foul air from the the rooms. Where these abnormal conditions were found, the teachers and janitors were instructed what should be done to remedy existing conditions.

"In some cases, where there was an excessive exhaust, it was found that the vent dampers had been thrown wide open and all the heat turned on in the vent flues, and, in some cases, where there was also a strong wind blowing across the top of the vent flue, which also increased the outflow. In some cases the supply of fresh air had been increased by opening wide the sources of supply and turning on the full amount of radiation. In other cases the rooms had been very much overheated and the teacher or janitor had, but a short time before, changed the mixing damper to allow cool air to come in to reduce the temperature of the room. In some rooms the temperature had been too low and additional heat had just been turned on. Vent dampers had also been recently moved to shut off or to increase the outflow of air.

"In some, the buildings were old and loosely-constructed wooden structures and where a strong wind would force a large amount of air in at places other than at the regular supply openings.

"In others, a room would be on the windward and exposed corner or side, and in

some others it would be on the leeward or protected side or corner. Sometimes there would be a high wind blowing and at other times it would be nearly calm.

"Mr. Whitten says 'Mr. Moore attributed the abnormal conditions to some rooms robbing the others.' In one case, where a small room was warmer than the incoming air at the inlet, it was explained that the room was in a protected part of the building, on the leeward side, with little outside wall or glass surface, and the other adjoining rooms were overheated, which had a tendency to increase the heat in that particular room, as the exhaust was in excess of the supply from the warm air inlet. It was not expected that this was to be taken as a fair representation of the many other cases.

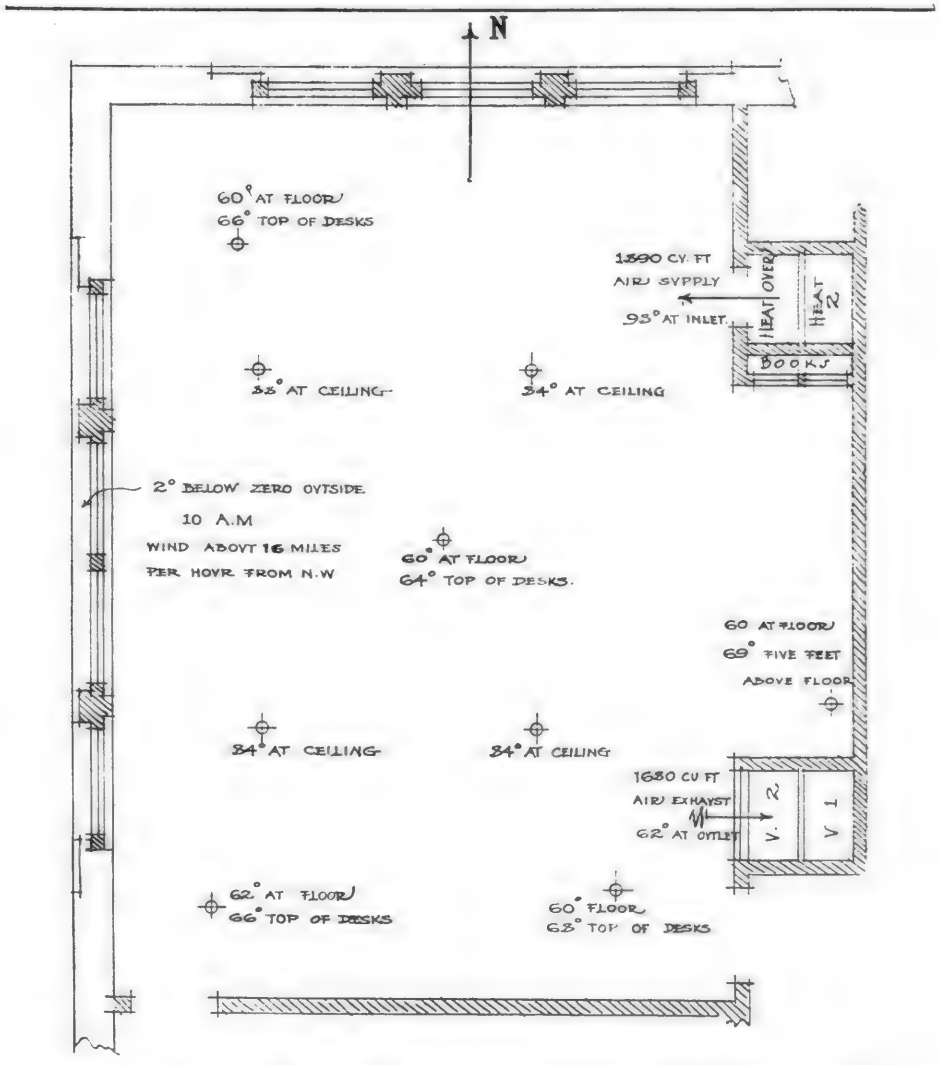
"To be of any real value, the conditions under which the observations were made should have been fully given in each case."

An Interesting Ventilation Test of a School Room

The accompanying diagram shows the results of a test made in one of the school rooms of the Housatonic School building, Great Barrington, recently.

The school is a 12-room brick building, with regular size class rooms to seat 42 pupils each. There is a central hall and the stories are 12 ft. 6 in. from floor to floor. All windows are equipped with Chamberlin metal weather strips.

The building is heated and ventilated to conform with Form 83A of the Massachusetts State Inspectors. Two 60-H.P.



TEMPERATURE RECORDS TAKEN JANUARY 4, 1910, IN FIFTH GRADE ROOM, SECOND FLOOR, HOUSATONIC SCHOOL BUILDING

Star water-tube boilers are located in the basement, delivering steam to the direct and indirect radiators. The school rooms are heated by radiators located in the fresh air chambers in the basement, the radiation being divided into two sections of not over 200 sq. ft. each. The fresh air chambers have windows through which outside air is admitted. Air ducts 22 x 30 in. lead from the fresh air chamber to the various school rooms, each duct having a mixing damper and adjusting damper.

The vent ducts leading from each room are 22 x 30 in. and connect with outlets through the roof. Each vent duct has an adjustable damper, also 20 sq. ft. of radiation to assist the movement of the vitiated air.

The results in one room as shown on the diagram were practically duplicated in other rooms of the same building. They also correspond in respect to the proportional results of air movements with the report of the State Inspector of an official test made Feb. 26, 1910.

Example of High Efficiency of Heating Plant with Reduced Air Leakage

BY F. K. DAVIS

In the past a great deal has been written regarding the economy of house heating plants, and in almost every instance the economy claimed has been secured by the adoption of some special generator or system of transmission, no particular attention being paid to how it was lost after it was delivered to the room for which it was intended.

As the average domestic heating plant is in the hands of either careless or unskilled help, and it is never possible to obtain to any degree the efficiency expected or theoretically possible, for this reason the relative economy of the domestic heating plant is very low.

Some progress, however, is being made along the line of conserving the heat delivered to the building, and, from the results obtained, it would indicate that after all this may perhaps be the true solution of the problem of how to economically yet satisfactorily heat the domestic building of the future.

The following example is taken as a typical installation along this line, and inasmuch as it has been fired and looked after by the housemaid it has had no special advantage in this respect over the average domestic plant.

A frame house, stucco and half timber, of ordinary construction, containing 443 sq. ft. of exposed glass, 1,853 sq. ft. of net exposed wall and 21,500 cu. ft. contents above the basement, and occupied as a residence.

This house is heated by a two-pipe, gravity-circulation, open-tank, hot water heating system, with an outside temperature of 10° F. A water temperature of 130° F. at the boiler will readily heat every room in the building to 70° F., yet there is only installed 473 sq. ft. of radiation divided in twelve radiators, mostly 32-in. 2-col. cast iron, and in only two rooms are they placed under the window; elsewhere they are placed in corners and out-of-the-way places, no particular attention being paid to having them on the coldest sides of the rooms. In some instances they are placed on the inside or warm wall. No pipe covering was used on the basement mains and branches, these being left bare to heat the basement.

On the assumption that 1 sq. ft. of exposed glass or 4 sq. ft. of exposed wall will lose 1 B. T. U. per degree difference between inside and outside temperatures, the heat loss from this house (above basement) would be, at 10° F., 54,360 B. T. U. per hour. It is reasonable to assume that there is a drop of at least 10° between the temperature of the water in the boiler and the temperature of the water, as an average, in the radiator. This would give a net difference between the air in the room heated and heating medium of 50° F., with which we have been able to raise the temperature of the house 60° when the glass equivalent is 1.91 to 1 sq. ft. of radiating surface.

This will readily show an efficiency not commonly obtained. The boiler economy is good; anthracite pea coal is burned on a grate having 3.3 sq. ft. area.

These figures are the more interesting when it is considered that this particular house has considerable north and west exposure and is not in any way shielded by other buildings.

The high efficiency shown has been secured by eliminating the window leakage by means of metal weather strips and a careful distribution of the radiation, so that even heating would result. The metal weather stripping was arranged for when the house was built, and the heating layout made accordingly.

It would seem that there is not enough attention paid to the air leakage in buildings and its elimination, as the economy shown in this case would more than repay the cost of treating the openings. In this case the original saving in the size of the heating plant as originally planned, and afterward reduced, more than offset the cost, besides making a saving of at least 50 per cent. in fuel yearly. From these results it would seem to indicate that instead of going to extreme care in generating heat and delivering it to the separate rooms in the building, true economy would lie in conserving the heat to its intended function of warming the building and not wasting it through crevices.

For the past three years the writer has been making tests and gathering data along this line, and will state that heat losses from leakage are greater than is ordinarily suspected, and in certain cases runs so high as to be almost unbelievable.

Current Heating and Ventilating Literature

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

HEAT TRANSMISSION

Heat Transmission in Pipes. Gives account of results obtained by Dr. W. Nusselt in experiments on the heat transference of gases—air, carbon dioxide, coal-gas, etc., passing through pipes at various pressures and velocities. 1800 w. Engg—Dec. 31, 1909. 40c.

The Coefficient of Heat Conductivity of Gases and Superheated Steam. Describes investigation on the dependence of the coefficient on the velocity of flow; gives results of experiments. 2400 w. Dingler's Poly. Jl—Dec. 18, 1909. 60c.

HEATING CARS BY ELECTRICITY

The Cost of Heating Cars Electrically. 1700 w. El. Ry. Jl—Dec. 18, 1909. 20c.

STEAM

A New Formula for the Total Heat of Steam. Robert H. Smith. Gives simple formula which accurately represents the values given in recently issued steam tables. 1400 w. Engr—Dec. 24, 1909. 40c.

PUBLIC BUILDINGS

The Warming and Ventilation of Public Buildings and Factories. T. W. Aldwinckle. Read before the Assn. of Engrs.-in-Charge. Deals with general principles, illustrating by examples. 2500 w. Archt. Lond—Jan. 14, 1910. Serial. 1st part. 40c.

VENTILATION

A remarkable Theatre Ventilating Plant. Illustrates and describes features of design and operation of the Nuremberg theatre, which are contradictory to prevailing practice in the United States. 7500 w. Met Work—Jan. 15, 1910. 20c.

Sanitary Provisions of Chicago's Proposed Street Car Ordinance

Included in the proposed code for regulating the ventilation and sanitary condition of Chicago's street cars are the following provisions:

There shall be introduced into every car 350 cu. ft. of air every hour for each passenger.

The minimum amount of air to be introduced into a loaded surface or elevated coach shall be 28,000 cu. ft. each hour.

There shall be at no time in excess of one-tenth of 1% of carbon dioxide gas in the atmosphere which passengers have to breathe.

The air shall be conducted into the car through the floor.

Exhausted air shall be conducted out of the car through overhead ventilators, but no air shall be allowed to enter by that route.

During cold weather the air which is admitted shall pass over heating coils and be warmed as it comes in.

In any car or part of a car where smoking is permitted, the supply of air shall be at least one-third greater.

Spittoons must be provided for smokers, and they must be of a kind easily cleaned and not easily overturned.

CORRESPONDENCE

Live Steam Versus Exhaust Steam for Heating

EDITOR HEATING AND VENTILATING MAGAZINE:

Referring to Mr. George H. Gibson's article in your issue of February, I do not think he has gone quite far enough in his calculation of the amount of heat transmitted by a radiator supplied with superheated steam. His data are as follows:

In a 14-in. pipe in which superheated steam at an average temperature of 590° was flowing at a rate of 16,000 lbs. per hour, the heat loss by radiation was 0.854 B. T. U. per square foot per hour per degree difference between the temperatures of the steam and of the room.

When saturated steam at a temperature of 380° was flowing in the pipe, the coefficient of heat loss was 1.63 B. T. U. This latter figure corresponds closely to the figures commonly obtained in tests of cast iron radiators with saturated steam, at about 212°.

Mr. Gibson calculates from these data that a radiator supplied with exhaust steam at atmospheric pressure will transmit about 54° more than it will transmit if supplied with superheated steam of the same pressure and a temperature of 247.5°, obtained by passing saturated steam of 20 lbs. pressure through a reducing valve, assuming in both cases a room temperature of 65°. His calculation may be abridged as follows:

	B. T. U.
Superheated steam, 247.5°, temp. diff. 182.5 × 0.854 equals.....	155.9
Saturated steam, 212°, temp. diff. 147 × 1.63 equals.....	239.6
Increase = 53.7% of 155.9 =	83.7

I submit that this calculation does not cover the case. It would be correct if the superheated steam flowed through the radiator so rapidly as to remain superheated and at an everage temperature of 247.5°, but it is far from being correct if the radiator

is supplied, as is usual, with only enough steam to furnish the heat radiated. In this case the steam will rapidly be cooled and become wet steam, and the coefficient of transmission will become the same as that for exhaust steam heating. Let the radiator be a long pipe of 100 sq. ft. of surface. Let x = number of sq. ft. passed over while the steam is cooling from 247.5° to 212°, and 100 — x the number of sq. ft. passed over while the steam is condensing at 212°. Then the mean temperature of the superheated steam = 230°, temp. diff. = 230 — 65 = 165. Heat transmitted per hour = x × 165 × 0.834 + (100 — x) × 147 × 1.63 = 23,961 — 380.5x.

As a first approximation to the value of x, assume the mean coefficient for the whole pipe at 1.50 and the mean temperature difference 150°, then the heat transmitted would be 100 × 150 × 1.5 = 22,500 B. T. U., and from this x would equal 4 sq. ft. This amount of heat would be furnished by the condensation of 22,500 ÷ 970 = 23.2 lbs. of steam at atmospheric pressure.

Taking 0.48 as the specific heat of superheated steam, this 23.2 lbs. would give up heat in cooling from 247.5° to 212°, 23.2 × 32.5 × 0.48 = 352 B. T. U., and this cooling would be effected by x sq. ft. of cooling surface. x = 352 ÷ (165 × 0.854) = 2.5 sq. ft. nearly.

Taking a nearer approximation, x = 2.7, we have B. T. U. transmitted = 2.7 × 165 × 0.854 + 97.3 × 147 × 1.63 = 23,694. 23,694 ÷ 970 = 24.43 lbs. 24.43 ÷ (32.5 × 0.48) = 2.7 sq. ft.

The heat transmitted by the radiator supplied with superheated steam is 23,694 B. T. U., as compared with 100 × 147 × 1.63 = 23,961 B. T. U., which would be transmitted by the radiator using exhaust steam. This is a difference of only 267 B. T. U., or a little over 1%, instead of the 54% shown by Mr. Gibson's calculation.

WILLIAM KENT.

Montclair, N. J., Feb. 24, 1910.

Scope of Work of the Publicity Committee

Plans have already been laid by the Committee on Publicity of the American Society of Heating and Ventilating Engineers to secure the publication of information and data pertaining to the general subject of ventilation, to co-operate with other organizations to improve living conditions, to furnish information regarding ventilation to boards of health or newspapers, when desired, and in other ways, which may appear later, to educate the public to a realization of the benefits of proper air sanitation.

The committee, as organized, has a member in each state, and those interest in furthering its work may get in touch with the committee through the secretary of the society, William M. Mackay, 113 Beekman treet, New York.

New Standing and Special Committees Appointed

President James D. Hoffman has named the following committees to carry on the duties assigned to them during the ensuing year:

COMPULSORY LEGISLATION

John F. Hale, chairman, Chicago.
Theo. Weinshank, Indianapolis.
H. W. Whitten, Boston.
Fred R. Still, Detroit.
H. D. Crane, Cincinnati.
Frank E. Baker, Oskaloosa, Iowa.

STANDARDS

Prof. R. C. Carpenter, chairman, New York.
J. J. Blackmore, New York.
August Kehm, Chicago.
H. C. Meyer, Jr., New York.
W. W. Macon, New York.

TESTS

Prof. J. R. Allen, chairman, Ann Arbor, Mich.
R. A. Widdicombe, Chicago.
Chas. R. Bishop, Lockport.
C. Teran, New York.
Byron T. Gifford, Chicago.

LEGISLATION FOR NEW YORK STATE

D. D. Kimball, chairman, New York.
C. B. J. Snyder, New York.
W. M. Mackay, New York.
W. W. Macon, New York.
R. C. Carpenter, New York.
Frank K. Chew, New York.

INTERPRETATION OF CONSTITUTION

Wm. G. Snow, chairman, Boston.
W. M. Mackay, New York.
William Kent, Montclair, N. J.
A. E. Kenrick, Brookline, Mass.
C. B. J. Snyder, New York.
W. F. Wolfe, Philadelphia.
Frank K. Chew, New York.

BOILER RATINGS

Edw. D. Densmore, chairman, Boston.
Reginald Pelham Bolton, New York.
James Mackay, Chicago.
James A. Donnelly, New York.
Ralph A. Collamore, Detroit.

RELATIVE CORROSION OF WROUGHT IRON AND STEEL PIPES

T. N. Thomson, chairman, Scranton, Pa.
Thomas Barwick, New York.
James A. Donnelly, New York.

ATMOSPHERIC VACUUM HEATING SYSTEMS

George D. Hoffman, chairman, Chicago.
D. F. Morgan, Chicago.
C. F. Newport, Chicago.

MECHANICAL VACUUM HEATING SYSTEMS

A. M. Feldman, chairman, New York.
Henry Adams, Baltimore, Md.
Frank H. Stevens, Chicago, Ill.

REVIEW COMMITTEES RE-APPOINTED.

Standards—Prof. R. C. Carpenter, New York.

Ventilation in General—Thomas Barwick, New York.

Fans and Fan Systems—Burt S. Harrison, New York.

Radiators and Heaters—W. W. Macon.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Date of Annual Convention Fixed

June 13, 14, 15 and 16, 1910, have been fixed as the dates of the twenty-second annual convention of the National Association of Master Steam and Hot Water Fitters. Atlantic City, N. J., had already been named as the place for holding the convention. The convention has been held many times at the Atlantic coast resort, which has always proved a popular and attractive meeting place.

Paul Steam System Company Sues City of Chicago

A suit of unusual importance has been instituted by the Paul Steam System Company through the United States Circuit Court against the city of Chicago for royalties in consequence of alleged infringements of the company's patents. The bill which has been filed sets out that the royalties due amount to over $300,000. They cover the devices used in heating systems installed in Chicago's public schools during the last six years, which are claimed to infringe the Paul Company's patents. The alleged infringements cover a much longer period, but the statute of limitations of six years confines the suit to the period stated.

The United States government, it is learned, has not only recognized the validity of the Paul Steam System Company's patents, but paid royalties for the use of the system in the Federal building in Chicago and in the United States Patent Office at Washington.

American Radiator Company Reports Banner Year

According to the report of the American Radiator Company, submitted at its annual meeting in Orange, N. J., March 2, the earnings of the company for the fiscal year ending Jan. 31, 1910, were the largest in the history of the company. Net profits were $971,599, over $70,000 above those for the year previous.

In addition to the payment of 7% on the preferred stock, the amount available for dividends on the common stock was $761,599 or 15.23%, as against 13.82 for the preceding year. During the year the company added $281,920 to its plant account and reduced its depreciation charges $200,000.

James B. Forgan, James B. Dill and Henry Bond were re-elected directors. At a special meeting of the stockholders following the annual meeting, it was voted to offer for subscription 8,000 shares of the unsubscribed and unissued common stock of the company. The stock will be offered to stockholders of both common and preferred, at $150 a share in cash on the basis of one share of new common stock for each ten shares of stock, both common and preferred. By this arrangement there has been authorized $3,000,000 of preferred stock and $7,000,000 of common stock, the total capitalization remaining as at present, $10,000,000. The present stock, however, is equally divided between common and preferred, there being $5,000,000 of each. The proceeds of the subscription, $1,200,000, will be employed in expanding the company's business.

The Future of Central Station Heating

The following which appeared in a paper in one of the Central Western States is interesting as showing the trend of the times in central station heating work:

The *News* would suggest to capitalists who seek fields for profitable investment, the glorious possibilities that are offered here for the establishment of central heating plants. It need not be necessary to attempt to have one plant supply heat for the entire city, but the territory might be divided so that several independent corporations could operate. In a number of cities in the Central West, ranging in population from 5,000 to 20,000, hot water heating plants have lately been established to the profit of both the operating companies and the people. A perfect heat is provided at a decidedly reasonable cost and householders are relieved entirely of what is a vexatious and trying winter task. The improved machinery now employed at these heating plants gives remarkably satisfactory results to the patrons and the temperature of each house can be regulated to the wishes of its occupants.

The absolute necessity of the careful conservation of the nation's fuel supply will very shortly render the establishment of central heating plants imperative, and it will be found that at a cost but slightly in excess of that now exacted to heat the house indifferently a highly satisfactory and unvarying temperature will be provided. It is merely a question of a very few years when circumstances will force the central heating plant upon the people of this section, and the pioneers who might now take hold would be taking time by the forelock, to their own profit and advantage.

Commercial Cards of Identification

Vice-Consul James L. A. Burrell reports that the Chamber of Commerce at Halberstadt, in the Magdeburg consular district, has recently begun to issue cards of identification to merchants upon request. These cards contain a photograph, a description and the original signature of the holder, to the correctness of which the Chamber of Commerce certifies. The cards can be used for identification at the post-offices, courts, etc. Their validity is not limited by time and they are issued free of charge.

A Feed-Water Heater and Receiver for Close Quarters

We have described in these columns an improved type of heater and receiver, combined with an extra large oil separator, for use with exhaust steam heating systems and fitted with valves so that the separator can remain in service while the heater itself is cut out of circuit.

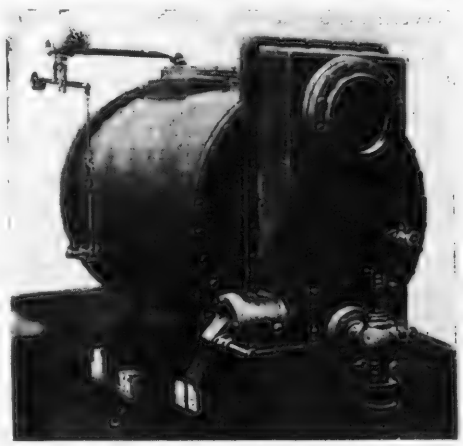
Frequently, however, there is not head-room enough for the upright rectangular type of heater and receiver, in which case the horizontal, cylindrical form is used, fitted with the surplus exhaust or steam-stack type of separator, as shown in the accompanying illustration.

The apparatus shown is peculiar in that the steam stack is not at the top of the separator, as is ordinarily the case, but from the side, still further reducing the amount of head-room required. The separator covers the whole end of the heater, or rather the separator and the drainage trap which disposes of the drips from the separator and of the overflow from the heater are both contained within the ring casting at the end of the heater, the shell of the heater being constructed something like that of a cylindrical surface condenser. A circular plate closes the end of the heater body proper and contains the port through which the steam enters the heater and the opening through which the waste from the heater overflow or skimming weir escapes into the trap. The separator ring is bolted fast against the plate. At one side of the separator casting is the surplus exhaust outlet, and below is the stuffing box for the lever to which is attached the float that operates the valve draining the trap.

Two semi-cylindrical valves on a common spindle serve to close the steam opening simultaneously, and thus to shut the separator off from the body of the heater when the latter is to be opened for cleaning or inspection while the heating system remains in operation. At the top of the spindle is a handle swinging horizontally over the top of the heater shell. The separator baffle plate, which serves to arrest the particles of oil and moisture carried by the current of exhaust steam entering the separator, is attached to the front cover plate of the separator, the steam passing around one side and then behind the baffle. When the steam valve is open, the steam is deflected into the heater, that is, the heater receives preference, the remainder of the exhaust steam passing to the surplus exhaust outlet.

At the opposite end of the heater shell are the cold water inlet and the float mechanism controlling the same, according to the level of the water in the heater. The opening for gravity returns is also at this end, as is the door for removing the trays over which the water is sprayed in the top of the heater, and the door for removing precipitated impurities and filtering material from the bottom part of the settling chamber.

However, the principal feature of interest about this heater is the use to which it



FEED WATER AND RECEIVER BUILT FOR CLOSE QUARTERS

has been put. It is installed between a steam engine and an absorption refrigerating machine, purifying of oil the exhaust steam passing to the reirigerating machine and receiving the condensed returns from the latter and such make-up water as may be required, and heating the same up to 210° F. for boiler feed. In order to be able to operate the ammonia generator at any desired pressure, the heater has been made with a solid shell to withstand a maximum pressure of 40 lbs.

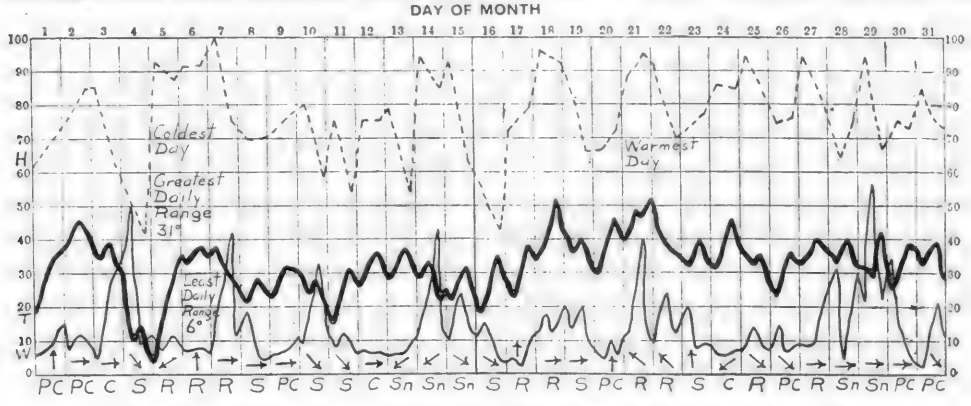
The apparatus was made by the Harrison Safety Boiler Works, 3189 North 17th St., Philadelphia.

Institution (British) of Heating and Ventilating Engineers

The tenth annual meeting of the Institution (British) of Heating and Ventilating Engineers was held in London, Feb. 15. A paper was read by A. H. Barker on "The Regulation of Heat by Control of Steam Pressure." The committee on boiler ratings advised the meeting that it was not yet ready to submit a definite report on the subject. The summer meeting of the institution was set for June 22 at Bournemouth.

The Weather for January, 1910

	New York	Boston	Pittsburg	Chicago	St. Louis
Highest temperature, deg. F.	51	57	51	46	61
Date of highest temperature	21	22	20	26	1
Lowest temperature, deg. F	5	—3	7	—5	3
Date of lowest temperature	5	4	4	7	6
Greatest daily range, deg. F	31	31	26	27	25
Date of greatest daily range	5	4	11	5	7
Lowest daily range, deg. F	6	4	5	2	5
Date of least daily range	6	31	12	12	14
Mean temp. for month, deg. F	32	32	31	26	33
Normal mean temp. for this month	30.6	27	31	24.4	32
Total rainfall, inches	5.61	4.25	5.33	3.07	2.73
Total snowfall, inches	16.6	11.9	22.3	14.8	1.1
Normal precipitation, this month	3.80	3.75	2.96	2.10	2.42
Total wind movement, miles	9163	8588	8085	11664	8865
Average hourly wind velocity, miles	12.3	11.5	10.9	16	11.9
Prevailing direction of wind	N. W.	West	West	West	N. W.
Number of clear days	7	6	1	5	7
Number of partly cloudy days	10	9	9	6	9
Number of cloudy days	14	16	21	20	15
Number of days on which rain fell	9	6	4	4	6
Number of days on which snow fell	5	9	12	9	2
Snow on ground at end of month, inches	None	Trace	3.7	5.2	0.3


DAY OF MONTH
Coldest Day
Warmest Day
Greatest Daily Range 31°
Least Daily Range 6°
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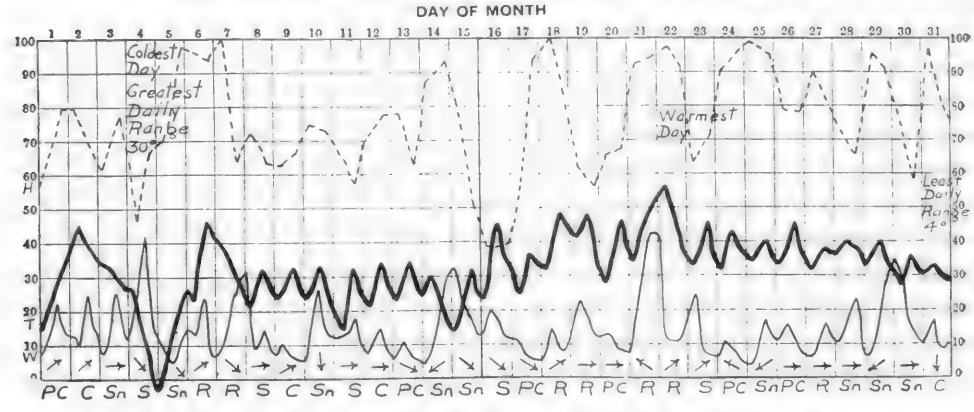
RECORD OF THE WEATHER IN NEW YORK FOR JANUARY, 1910


DAY OF MONTH
Coldest Day
Greatest Daily Range 30°
Warmest Day
Least Daily Range 4°
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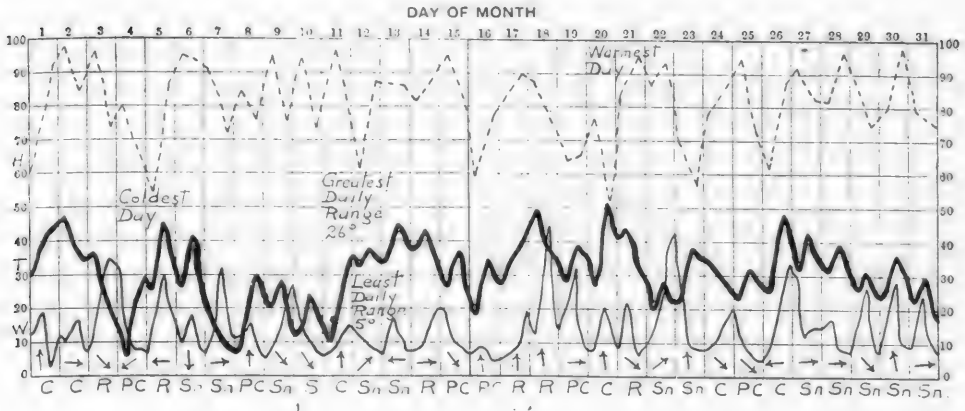
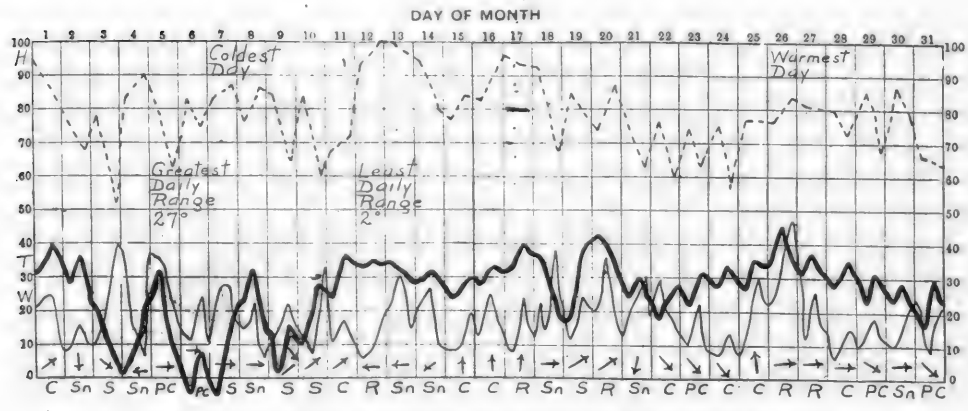
RECORD OF THE WEATHER IN BOSTON FOR JANUARY, 1910

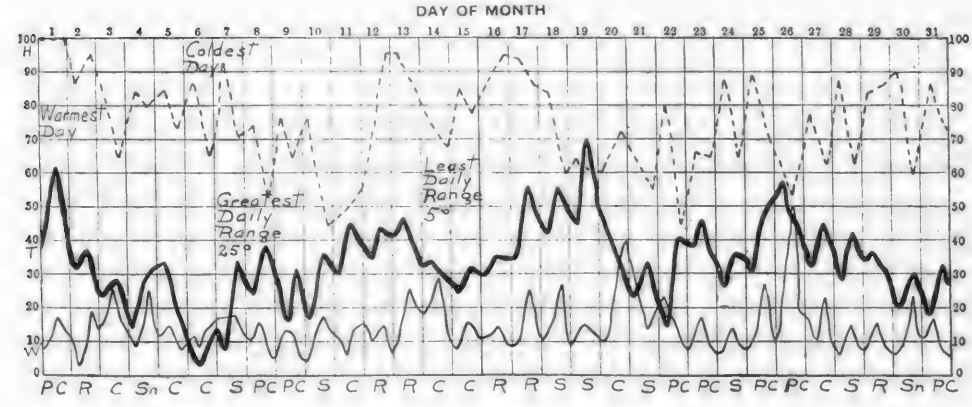
Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage.
S—clear, C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.



RECORD OF THE WEATHER IN PITTSBURG FOR JANUARY, 1910



RECORD OF THE WEATHER IN CHICAGO FOR JANUARY, 1910



RECORD OF THE WEATHER IN ST. LOUIS FOR JANUARY, 1910

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage.
S—clear, P C— partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

Trade Literature

Little Niagara Sanitary Air Washer, manufactured by Louis Naroweth, Chicago, is the subject of an interesting catalogue in which this apparatus, patented Dec. 22, 1908, is described at length. Special attention is called to the fact that this design of air washer has no spray heads or nozzles. The washer consists of a tank base primarily for the storage of water. The tank can be used for holding cooling coils or ice, if necessary. There is the usual casing, consisting of two sides and top, leaving the ends free for the passage of air. Within the casing are a series of horizontal, vertically-inclined-forward shelves, from the front of which a series of removable screens are suspended. At the rear are placed a series of removable baffles.

The water is brought to the top shelf through a number of unrestricted openings and is distributed over a spreader the entire width of the washer. The water, which is evenly divided by this spreader, flows along the length of the shelf, down over the screens, forming a solid curtain of water. The entering air passes through this sheet of water and is divided by the screen into small streams, this arrangement being designed to present the greatest possible amount of contact between air and water. The air in passing through this sheet produces a similar effect to boiler water, and is described as analagous to the vapor rising through boiling liquid.

If from this effect any drops of water are carried along, they are either deposited on the inclined shelf or on the baffles. The water deposited on the inclined shelf flows downward and over the next screen below, so that the lower screen has practically the same quantity of water as the upper screen. The water collected by the baffles is returned to the tank, whence it is again circulated by means of a centrifugal pump driven by an independent motor or by means of the apparatus producing the air circulation. The catalogue contains sample testimonials, together with views of buildings in which the "Little Niagara" air washer is installed.

Dehn's Acme Automatic Back Water Traps and Combined Adjustable Floor Drains are the subject of some effective placards, published in series form, and showing the various applications of the trap, which is manufactured by the Compound Injector & Specialty Co., 419-442 North 52d avenue, Chicago. One of the interesting views shown displays the drain equipped with a large receiving hood and with hub for connections below cement floors. The trap is classed as an open fixture and is approved by sanitary experts.

Nelson Valve Co., Chestnut Hill, Philadelphia, announces, through a descriptive circular, that it has acquired the patent rights of the Huxley valve, which will hereafter be manufactured by the Nelson Valve Co. The merits of the Huxley disk have long been known to the trade and the prospect of the manufacture of this valve on an extensive scale is an item of much interest to the trade. Among the advantages which are mentioned for the Huxley valve are that its disks and seats are renewable at very small cost, the

HUXLEY BRONZE GLOBE VALVE

shell of its seat is tapered, thus fitting the valve tightly, and the disk holder is so made as to fit any kind of disk. This arrangement gives the valve all the advantages of a regrinding valve without making regrinding necessary when the valve leaks.

Guillot Metal Gasket & Supply Co., 24-30 South Clinton street, Chicago, dealers in fiber and metallic packings and engine room supplies, is sending out a well-illustrated and handy catalogue, displaying its full line of copper and metallic gaskets for man and handhole plates and for steam and ammonia joints of any size or shape, also its line of oil pumps, etc. List prices and illustrations are given of each type of gasket and packing, as well as of the oil pumps, etc., the catalogue concluding with several pages of useful information on such subjects as feed water required by small engines and circumferences and areas of circles. Size 3 x 3½ x 6 in. (standard). Pp. 44.

TRADE AND MISCELLANEOUS NOTES

Coming Events

May 31-June 3, 1910.—Spring meeting of the American Society of Mechanical Engineers at Atlantic City, N. J. Headquarters at the Marlborough-Blenheim Hotel.

June 13, 14, 15 and 16, 1910.—Twenty-second annual convention of the National Association of Master Steam and Hot Water Fitters, Atlantic City, N. J.

June 21-23, 1910.—Twenty-eighth annual convention of the National Association of Master Plumbers, at Chicago.

Deaths

William Eustis Smith, former president of Smith & Anthony Co., Boston, Mass., manufacturer of heating boilers, died at his home in Boston, Feb. 18. He was 86 years old. He retired from the presidency of Smith & Anthony Co. about two years ago after having held that office for 28 years. He was one of the founders of the firm. He was previously selling agent and treasurer of the Magee Furnace Co., of Boston.

George J. Mast, of the George J. Mast Heating Co., Indianapolis, Ind., died Jan. 22.

James H. Blessing, president of the Albany Steam Trap Co., Albany, N. Y., died Feb. 27 of a complication of diseases. Mr. Blessing was one of the best-known men in the heating trade and was the inventor of many steam devices. He was elected mayor of Albany in 1899, being the first of the unbroken line of Republican mayors Albany has had since the new charter for second-class cities went into effect.

Miscellaneous Notes

Southern Supply & Machinery Dealers' Association and the American Supply & Machinery Dealers' Association will hold their joint convention in Jacksonville, Fla., April 5-7, with headquarters at the Seminole Hotel.

Alfred R. McGonegal has been appointed inspector of plumbing for the District of Columbia. He had been holding the office under a temporary appoint-

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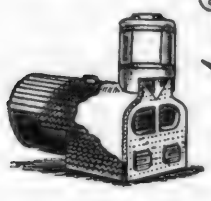

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85% MAGNESIA, ASBESTOS AND BRINE PIPE COVERINGS, ASBESTOS PRODUCTS, ETC.

ESTIMATES FURNISHED AND CONTRACTS EXECUTED.

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ment following the resignation of Henry B. Davis.

San Francisco, Cal.—Alfred Roncovieri, superintendent of schools for San Francisco, has recommended to the Board of Education that the use of steam boilers be discontinued in the public schools on the ground that they are not safe, unless arrangements are made for their regular inspection by the steam boiler inspection and insurance companies.

American Berlin Exposition, which was scheduled to be held in Berlin during the summer of 1910, has been postponed until 1911, the stated reason being that opposition has developed in Germany to the display of American goods in Berlin.

United Bunch of Sheep of America, Chicago fold, held a meeting and election January 28, followed by a dinner. The following officers were elected: Past grand ram, J. E. Ercanbrack; grand ram, Edward H. Eggleston; vice-ram, William J. Crowley; shepherd, Ira J. O'Malley; keeper of the golden fleece, Samuel Kaltenbrun; shearer, Stuart M. Murdock; directors, Walter S. Rait, Andrew P. Dease and Joseph W. Story.

Chicago.—Passage of a bakery ordinance, with special provisions for ventilation, lighting and equipment, has been recommended by the license committee of the city council. The ordinance was proposed by Health Commissioner Evans.

Watertown, S. D.—S. B. Hess, of Hess & Rau, has applied to the city council for a franchise to build and operate a central heating plant in that place.

Chicago Steam Heating and Ventilating Engineers, an organization of contractors formed as the result of a strike in the trade a few months ago, elected the following officers at its first annual meeting Feb. 1: President, S. A. Long; vice-president, Charles Glennon; secretary, George H. Kirk; treasurer, William Sullivan. The election was followed by a dinner.

Washington, D. C.—With the full approval and hearty coöperation of Mrs. Taft, wife of the President, the local committee of the National Civic Federation has undertaken an agitation for betterment of the conditions in unsanitary, unventilated and poorly lighted government buildings.

Evansville, Ind.—The Evansville Gas & Electric Light Co. has filed a petition with the board of public works asking for a franchise to build and operate a heating plant in Evansville. A similar franchise was granted last December to the Evansville Public Service Corporation.

Baltimore, Md.—Plans for the reorganization of the Baltimore Refrigerating & Heating Co. have been completed and the company will be known as the Baltimore Light, Heat & Power Co., provided the bill now before the state legislature passes, giving the company the right to sell electricity in the city of Baltimore.

Anderson, Ind.—Notice was issued of an election to be held March 15 on the question of installing a municipal steam heating plant in that city.

Lebanon Heating Co., Lebanon, Ill., is planning to spend $25,000 in improvements to its plant, including two new 500-H.P. boilers, steam condenser and forced draft system.

William Kent has been elected president of the Technical Literature Co., 220 Broadway, New York, publisher of *Industrial Engineering and The Engineering Digest.*

National Metal Trades Association will hold its twelfth annual convention at the Hotel Astor, New York, April 13 and 14, 1910.

Building Operations for January, 1910, in the leading cities of the country show a slight falling off as compared with those for the same month a year ago. Permits were taken out in 59 cities for the con-

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MAKES TIGHT JOINTS
by lubricating the threads and thus allowing the joints to be fully tightened up.
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JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY, N. J.

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OR BOILER DRY-PIPE
DRY STEAM—SAFETY—ECONOMY
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struction of 10,059 buildings, involving $40,815,520, as against 10,730 buildings, involving $43,137,377 for the corresponding month a year ago. Manhattan Borough, New York, shows a loss of 12%; Brooklyn a loss of 48%. Other cities showing losses are Pittsburg, 16%; Buffalo, 25%; Cleveland, 38%; Milwaukee, 24%; and Toledo, 23%. Gains are shown as follows: Philadelphia, 26%; St. Louis, 21%; Portland, Ore., 45%; Minneapolis, 59%; Kansas City, 26%; Cincinnati, 4%; Omaha, 4%; Indianapolis, 55%; and Louisville, 105%.

Manufacturers' Notes

C. A. Dunham Company and the National Vacuum Heating Co., Marshalltown, Ia., have commenced building their new $30,000 factory at Marshalltown, which, when completed, will be one of the best equipped in the state. Three buildings, including a main factory, power house and office, will be built at once, but the plant, when fully completed, will represent an investment of $65,000.

Johnson Service Co., owners of the Johnson system of temperature control, announces the removal of its New York office to 123 East 27th street.

Cameron-Schroth-Cameron Co., Chicago, announce that in addition to its Richmond line of boilers, radiators and tank heaters, it now controls the sale of the Model line of boilers, tank and laundry heaters.

Harrison Engineering Co., New York, manufacturers of the Harrison air tube heater, has opened a branch office in Philadelphia, in the Real Estate Trust building, Broad and Chestnut streets, with J. J. McKee as manager.

American Ship Windlass Co., manufacturer of the Tayor underfeed stoker, has recently built four 13-retort stokers for the Detroit Edison Co., to be used with two 2,300-H.P. Stirling boilers. They are said to be the largest stokers in the world.

Crane Co., Chicago, announces the purchase of a site in Oakland, Cal., upon which it will build a branch plant.

Hughes & Co., Spokane, Wash., jobbers of heating and plumbing supplies, will build a $45,000 warehouse in that city.

Kellogg-Mackay Co., Chicago, conducted an annual convention of its salesmen at its headquarters in Chicago, Feb. 2-4, 1910. A dinner of 120 covers to the visiting salesmen as well as the home office force was a feature of the second day of the convention.

Central Foundry Co., New York, manufacturer of cast-iron and soil pipes and fittings, and also owner of the stock of the Central Radiator Co., went into the hands of a receiver Feb. 12. The liabilities of the firm, which is known as the soil pipe trust, are given as $4,561,000, assets not stated. The company employed 1,500 men, its yearly payroll amounting to $1,000,000. Waddell Catchings, the receiver, has stated that there will be no interruption in the operation of the company's plants, which are located at Newark, N. J.; Dundalk, Md.; Anniston, Ala.; Bessemer, Ala.; South Pittsburg, Tenn.; Vincennes, Ind.; and Medina, N. Y.

United States Radiator Co., Dunkirk, N. Y., has appointed Charles A. Barker one of its sales representatives. Mr. Barker will be connected with the Chicago office. He was formerly with the Holland Radiator Co.

H. W. Johns-Manville Co., New York, has appointed Perry W. Rathbun one of its sales representatives at Omaha, Neb. He will be attached to the company's Milwaukee branch.

H. W. Johns-Manville Co., New York, is arranging to rebuild on a larger scale its plant at Newark, N. J., devoted to the manufacture of insulating products for refrigerating plant service, and which was recently destroyed by fire.

Model Heating Co., Philadelphia, is planning to move its New York office uptown to the Terminal building at Park

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are the original and only genuine "Jenkins" valves. They are the easiest to keep tight. They are strong, well designed, carefully constructed, and nicely finished. Don't take an *imitation* "Jenkins"—insist on having the kind which bear our trade mark, as shown in the cut, and you are guaranteed satisfaction.

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JENKINS BROS.

NEW YORK BOSTON PHILADELPHIA CHICAGO

avenue and 41st street. Quarters have been secured on the ground floor and the change will be made as soon as the rooms are ready.

Richardson & Boynton Co., manufacturers of the Richardson line of boilers, furnaces and ranges, announce the removal of its showrooms and business offices to its new quarters at 31 West 31st street, between Fifth avenue and Broadway, New York. The company will retain its storehouse at 232-236 Water street, where a stock of goods and repairs for the trade will be carried, as heretofore.

National Steam Specialty Co., Chicago, announces the removal of its factory and general office to 16-18 South Clinton street, Chicago.

Kewanee Boiler Co., Kewanee, Ill., has completed plans for its five new buildings which will be commenced as soon as the weather permits. The total cost of the work, including equipment, will be about $200,000.

American Radiator Co., Chicago, announces the following changes in its sales department: Frank B. Howell, assistant general manager of sales, transferred from New York to the home office in Chicago; F. W. Smith, district sales manager for the East, transferred to Brantford, Ont., Canada, as special sales representative; James D. Erskine, district sales manager, transferred from the Central West to the New York office.

Detroit Radiator Co., Detroit, Mich., will build a new factory in the spring.

H. W. Johns-Manville Co., New York, announces that, due to fast increasing business, both the Chicago and Baltimore branches of the company have outgrown their present quarters. The Chicago branch has moved to a four-story and basement building at 27-29 Michigan avenue, where 32,500 sq. ft. is available for carrying a full stock of J-M products. The Baltimore office and store and warehouse is now located at 30 Light street, where the company will be in a better position than ever before to fill orders.

Harrison Engineering Co., New York, has received orders for the Harrison air-tube system of heating to be installed in the Hemming Mfg. Co.'s plant at Garfield, and for the heating of a school building at Boonville, N. Y.

New Firms and Business Changes

Crane & Ordway Co., St. Paul, Minn., has increased its capital stock from $400,000 to $800,000.

Johnstown Engineering Co., Johnstown, Pa., has organized to conduct a heating and plumbing contracting business.

The Empire Low Pressure Steam Trap

Means Trap Satisfaction

The trap question will be settled if you install an EMPIRE. Adapted to all classes of low pressure work. Perfectly automatic in operation. THE SIMPLEST TRAP MADE. Let us send you one on trial. You will be surprised at its low cost too.

ASK FOR BULLETIN 101

AMERICAN DISTRICT STEAM COMPANY

LOCKPORT, N. Y. CHICAGO, ILL.

H. W. JOHNS-MANVILLE CO.

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SEND FOR CATALOG - OFFICE AND WAREHOUSE IN EVERY LARGE CITY.

King & Martin, Scranton, Pa., is the title of a new heating and ventilating contracting firm, located at 1614 Electric avenue.

H. O. Roberts Co., Minneapolis, Minn., heating and ventilating contractors and jobbers of heating goods, will move April 1 to new quarters at 109 Second street, South, where the firm has taken a 20-year lease.

Gibson-Schlemmer Co., Cincinnati, O., notice of whose incorporation was announced in our last issue, is a combination of the well-known Cincinnati contracting firms of the Thomas Gibson Co. and the Oliver Schlemmer Co.

Cherry City Plumbing & Heating Co., Salem, O., has opened an office in the D'Arcy block, that place.

Ambridge Hardware & Plumbing Co., 438 Merchant street, Ambridge, Pa., has been organized by J. C. Doyle and E. R. May, who have purchased the heating, plumbing business of the Doyle Plumbing Co. and Brenholts Bros.

Derheimer Bros., 523 East Jefferson street, Fort Wayne, Ind., has been organized to conduct a heating and plumbing business.

Gravity Heating Co., 5 Canal street, Woodhaven, Long Island, N. Y., has been organized to take over the business of Joseph A. Kent & Co., of Brooklyn. The new firm is composed of Joseph A. Kent, K. G. Agnew and L. L. Driggs.

Magnesia Asbestos Co., New York and Boston, manufacturer of asbestos materials, is arranging to enlarge its plants at Boston and Newark, N. J., and has authorized an additional issue of capital stock.

Des Moines, Ia.—John Newburn has purchased from W. B. Kinney the North Des Moines heating plant at West Seventh and North streets for $5,000. The plant comprises a hot-water system, sup-

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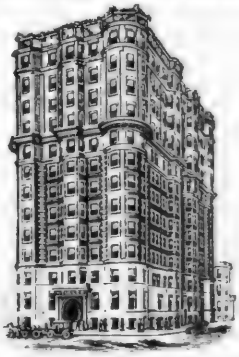

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plying heat to several residences. It is reported that the plant will be greatly enlarged.

D. Scott Co., Oelwein, Ia., dealers in heating and plumbing supplies, has moved its business to Waterloo.

Muskogee, Okla.—A plant for manufacturing steam and hot-water radiators of pressed steel, under patents granted to T. H. Walker, of that place, is being planned, according to reports. Among those said to be interested in the project are W. Z. Flanery, T. H. Walker and K. James Muir, of Kansas City.

New Incorporations

Central Heating Co., Waterloo, Ia., has incorporated with a capital of $15,000 to take over the business of the Fowler Heating Co., of that place, which has been operating a small central heating plant. The present capacity of the plant, 300 H.P., will be increased to 400 H.P.

Hunter Plumbing & Heating Co., Denver, Col. Capital, $5,000. Incorporators: Noble F. Hunter, Hervert C. Hunter and Loyal C. Hunter.

George T. Barnes Co., Newburgh, N. Y., capital $30,000, to conduct a heating and plumbing supply and contracting business. Incorporators: G. T. Barnes, E. C. Barnes and E. A. Haskins.

Anderson Heating Co., Camden, N. J. Capital, $100,000. Incorporators: Mortimer C. Anderson, H. Adele Anderson and David H. Goss.

McCoy-Nolan Heater & Supply Co., Milwaukee, Wis. Capital, $10,000. Incorporators: Frank E. Nolan, J. R. McCoy and G. C. Dutcher.

Herpick Co., New Haven, Conn., capital $50,000, to conduct a heating and plumbing business.

Central Heating Co., Des Moines, Ia. Capital, $150,000. Incorporators: F. C. Fowler, H. B. Plumb and W. R. Cole.

Franklin Plumbing & Heating Co., Hartwell, O. Capital, $10,000.

Batt & Co., Buffalo, N. Y., capital $25,000, to conduct a steam heating and plumbing business. Directors: Robert C. and Albert J. Batt and George W. Frank.

Modern Plumbing & Electric Co., Houston, Tex. Capital, $10,000. Incorporators: J. E., H. H. and C. A. Fisher.

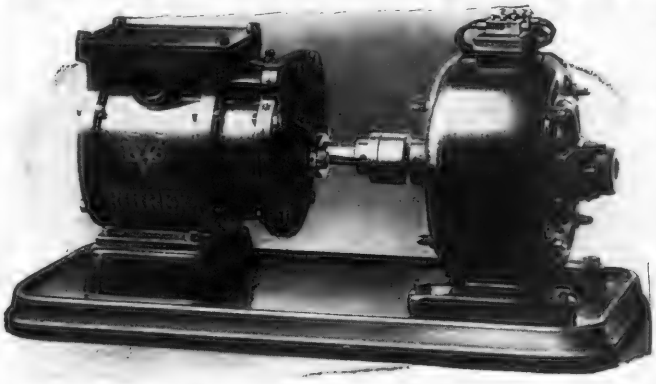
Valley Plumbing & Machinery Co., Brownsville, Tex. Capital, $10,000. Incorporators: J. W. Lamb, S. C. Tucker and E. L. Burke.

A. F. Fettig Plumbing & Heating Co., St. Louis, Mo. Incorporators: Alfred F. Fettig, Christopher Dunn and Martin Dorsey.

General Plumbers' Supply Co., Jersey City, N. J., capital $50,000, to deal in heat-

The "ROTREX" System of Vacuum Cleaning

not only insures the complete extraction of **all** dust and dirt but also insures its removal from the rooms and from the premises in the most sanitary manner yet devised.



The "ROTREX" System discharges **the dirt and dust direct to the sewer.**

With the "ROTREX" System there are no unsanitary dust receptacles or separating tanks of any kind.

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ing and plumbing supplies. Incorporators: J. Kennedy, Jersey City; S. Grossman, Brooklyn; and J. Jordan, New York.

R. T. Sales Co., Elizabeth, N. J., capital $10,000, to deal in hardware and heating and plumbing supplies. Incorporators: D. W. Henry and E. Lake.

Barber Plumbing, Heating & Electrical Co., Birmingham, Ala. Capital, $25,000. President, B. F. Rickman; vice-president, Charles B. Barnitz; secretary and treasurer, J. A. Sillman.

Hart Heater Co., Oakland, Cal., capital $50,000, to manufacture boilers. Incorporators: Charles Hart, P. L. Sternberg and C. W. Keith, all of Oakland.

Edwards Bros., Rockford, Ill. Capital, $20,000.

Wilke Implement Co., Oshkosh, Wis., capital $10,000, to carry on heating and plumbing contracting business, in addition to its general supply business.

James Hamill Co., Watervliet, N. Y., capital $30,000, to carry on a general heating, plumbing and hardware business.

A-One Mfg. Co., New York, capital $20,000, to deal in heating and plumbing specialties. Incorporators: William Van Norden and W. E. Rahlmayer.

Moore Heating & Mfg. Co., Akron, O. Capital, $10,000. Incorporators: T. E. Moore, E. H. Blackstone, A. T. Neiswange and E. W. Besaw.

Koller Plumbing Co., Cleveland, O., capital $10,000, to take over the business of Boehme & Kohler. George Kohler is one of the principal incorporators.

Genesee Engineering Co., Rochester, N. Y., capital $100,000, to manufacture and deal in heating and plumbing supplies. Incorporators: F. C. Allen, C. Wellman and G. T. Graning.

Williams-Clark Co., Schenectady, N. Y., capital $10,000, to conduct a heating and plumbing business. Incorporators: Geo. W. Clark, Delos H. Williams and Elsie H. Williams.

John Mannion Co., Terre Haute, Ind., capital $10,000, to conduct a heating and plumbing business. Incorporators: Thos. Maloney and John J. Mannion.

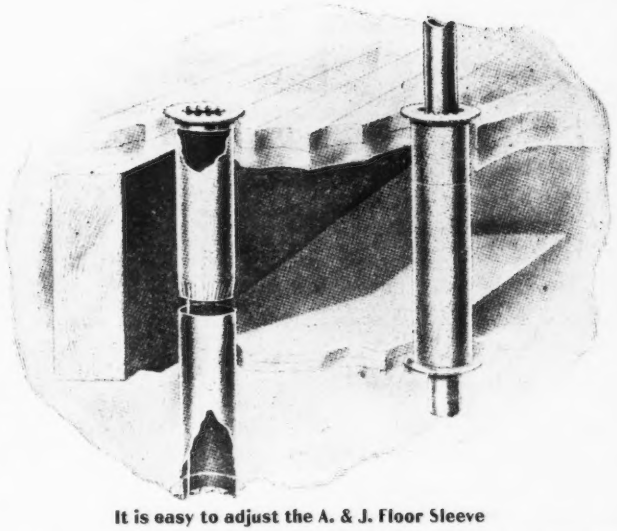
M. Kennedy and Henry Calhoun Co., Troy, N. Y., capital $12,000, to conduct a heating, plumbing and gas fitting contracting business. Incorporators: Michael Kennedy, H. J. Kennedy, Henry and S. Calhoun.

Atlantic Heating & Engineering Co., Trenton, N. J. Capital, $20,000. Incorporators: Edward C. Hinkle, William T. Brown and Oliver P. Caldwell.

Bettendorf Plumbing & Heating Co., Des Moines, Ia., to engane in a heating and plumbing contracting business. Incorporators: J. W. Bettendorf, Oscar and Edward Wernentin.

The A. & J. Floor Sleeve Is Built on the Telescope Plan

The sleeve is used for insulating steam pipes running through floors and partitions. The telescope construction admits of an adjustment of from 12 to 24 inches. The illustration shows the position of ceiling plate and strap before ceiling is finished. The strap, which is riveted to the upper section of sleeve, allows the ceiling plate to hang below the plaster from 4 to 6 inches. After the ceiling is properly finished, the plate, or lower section of sleeve, is adjusted in place, the strap cut to the proper length and formed around the lip of lower plate, thereby firmly holding the sleeve in place.



It is easy to adjust the A. & J. Floor Sleeve

Send for price list on sizes ranging from ½ inch to 8 inches, from which a liberal discount is allowed.

Manufactured by

MELLISH-HAYWARD CO., Chicago, Ill.

Marvel-Spencer Heating Co., Milwaukee, Wis. Capital, $10,000. Incorporators: J. S. Brennan, F. H. Meadows and A. Jendrzejewski.

Eureka Water Heater Co., Chicago. Capital, $10,000. Incorporators: Ernest Peterson, H. W. Boyd and Otto Fetting.

C. J. Leary Plumbing & Heating Co., New Rochelle, N. Y. Capital, $5,000. Incorporators: Cornelius J. Leary and others.

International Asbestos Corporation, capital $40,000,000, comprising American and Canadian asbestos mine owners and manufacturers, was organized recently in New York, with the following officers: President, T. F. Manville; vice-president, R. V. Mattison, Jr.; secretary, R. P. Doucet. The new combination includes the Amalgamated Asbestos Corporation, Ltd.; Keasbey & Mattison Co.; Philip Carey Mfg. Co.; Asbestos Protected Metal Co.; Franklin Mfg. Co.; H. W. Johns-Manville Co.; Sall Mt. Asbestos Mfg. Co.; Ling Asbestos Co., and the United States Asbestos Co.

Pike-Tay Co., San Francisco, Cal., capital $100,000, to deal in oil well supplies. Among the incorporators are Edward H. Kinney, Francis J. Baker, P. E. Mack, T. H. and P. M. Pike. Among those who are interested are several of the principal stockholders of the heating and plumbing supply house of George H. Tay Co.

Contracts Awarded

Phillips & Getschow, Chicago, heating the Woodruff building at Joliet, Ill.

E. J. Erbelding, Augusta, Ga., hot-water heating new fire headquarters in that city for $2,600.

Newport Engineering Co., Portland, Ore., central heating plant at State Insane Asylum, Salem, Ore., to cost $49,730.

L. W. Pomerine, Lincoln, Neb., heating and plumbing addition to the Hastings Asylum for $8,695.

Peters-Eichler Co., St. Louis Mo., heating system and power plant for the Carter building, Houston, Tex.

Wanted

A representative wanted in every large city for the New York Heating and Ventilation School. Outside man who comes in contact with the heating and ventilating trade and architects preferred. Write, giving references. Address NEW YORK HEATING AND VENTILATING SCHOOL, 1123 Broadway, New York.

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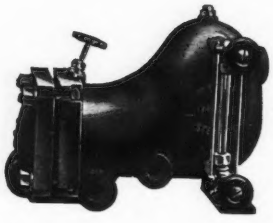

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ADDRESS

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Paul Steam System Company Sues City of Chicago for $300,000

A suit of unusual importance has been instituted by the Paul Steam System Company through the United States Circuit Court against the City of Chicago for royalties in consequence of alleged infringements of the company's patents. The bill which has been filed sets out that the royalties due amount to over $300,000. They cover the devices used in heating systems installed in Chicago's public schools during the last six years, which are claimed to infringe the Paul Company's patents. The alleged infringements cover a much longer period, but the statute of limitations of six years confines the suit to the period stated.

The United States government, it is learned, has not only recognized the validity of the Paul Steam System Company's patents, but paid royalties for the use of the system in the Federal building in Chicago and in the United States Patent Office at Washington.

—*Chicago News Item.*

The Skiffington and other patents owned by the Paul Steam System Company are fundamental and cover any vacuum system of heating having a pipe leading from the return end of a radiator or heating unit and connected with a vacuum pump or other exhausting device, whether containing a valve or other means for permitting the escape of air, or air and water, while automatically restricting or preventing the escape of steam.

Architects and contractors should caution their clients against the liability and expensive litigation sure to follow an infringement of our patents. Contractors themselves must realize if they install infringing systems they become liable for three times the cost or price regularly charged for such installation.

PAUL STEAM SYSTEM COMPANY

90 West Street, New York

By JAMES E. HEG, President

John G. Sutton & Co., San Francisco, heating and ventilating Holly Park School for $11,880.

Blumve & Jay, Los Angeles, Cal., steam heating pavilion and annex to Nurses' Home at the County Hospital, that city, for $2,275.

W. W. Campbell & Sons, Boston, heating and ventilating U. S. Naval Hospital buildings at Chelsea, Mass.; Newport, R. I., and Portsmouth, N. H., for $65,000.

Martin & Wigman, Green Bay, Wis., heating and ventilating new Rock County almshouse at Janesville.

Robert Dalziell, Jr., Co., San Francisco, heating and ventilating addition to the Children's Hospital and Training School for Nurses, that city, for $43,500.

A. H. Julian, San Diego, Cal., heating new Hall of Records in that city for $2,965.

Lewis & Kitchen, Kansas City, Mo., heating system for new school building in Waterville, Kan.

George Thomas, Mt. Pleasant, Ia., heating and plumbing new high school building at New London, Ia., for $2,008.

Business Chances

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until March 17, 1910, for the construction of the U. S. Post Office, Court House and Custom House at Richmond, Va.

Until March 21, 1910, for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Lincoln, Ill.

Until March 25, 1910, for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Lexington, Ky.

Until March 28, 1910, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring and standard clock system) of an extension, remodeling, etc., to the U. S. Post Office at Quincy, Ill.

Until April 11, 1910, for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Ashtabula, Ohio.

Minneapolis, Minn.—Plans are being discussed at Macalester College to install a central heating plant, facing Macalester avenue and south of the new Carnegie Science Hall, now being built.

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